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[OFFICIAL NOTICE.]

Twelfth Annual Meeting Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION,
QUINCY, ILLS., May 4, 1889.

The Twelfth Annual Meeting of the Western Gas Association will be held at Cincinnati, Ohio, on the 15th, 16th and 17th days of May. The "Grand" which has been secured by the local Committee of Arrangements for our headquarters, has been lately refitted, as well as greatly improved in all respects, and is now one of the finest hotels in the country. The business sessions of the Association will be conducted in a large room within the hotel building, and for quiet, comfort and coziness, the arrangement is all that could be desired. The hotel rates have been reduced to $3 per day to the members of the Western Gas Association and their guests. It may be well to bear in mind that the Grand Hotel is but one block away from the Grand Central Railway Depot, at which place about all the delegates to attend the convention will arrive. The convenience of this speaks for itself.

A reduction in transportation rates has also been secured, for those who will be in attendance, in the territory of the Central Traffic Association, which is bounded on the East by Pittsburgh, Buffalo and Toronto; on the North by the line of, and including points on the Grand Trunk Railway, from Toronto to Port Huron, thence via Lakes Huron and Michigan to the North line of Cook County, Illinois; on the West, by the West line of Cook County and the Illinois and Mississippi rivers to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the South by the Ohio river. As promised in my earlier notices, the necessary information as to the manner and method of obtaining the concession in railway rates, has been mailed to each member.

I am gratified to be in position, owing to the courtesy and promptness with which the contributors of papers have responded to my appeal for the titles of their essays, to present the following index to the literary treat that is in store for the members. The list is appended:

"Meter Accounting: Do I lose any Meters?" by G. A. Hyde, Jr.

"On the Use of Crude Oil for Firing Bench Furnaces and Enriching Coal Gas," by J. H. Woodmansee.

"Incandescent Gas Lighting," by John McIlhenny.

"Inclined Retorts," by R. D. Walsh.

"Retort House Work," by Geo. T. Thompson.

"Retort Furnaces for Burning Coal," by K. M. Mitchell.

"Fuel Gas," by Chas. R. Faben, Jr.

"Points on the Management of Small Gas Works, as Deduced from Twenty-five Years Experience," by L. P. Gerould.

"The Education of the Gas Engineer," by John Gimper.

Mr. Walter L. Brown, who is now in charge of the works at Evanston, Ills., has given a conditional promise of a paper, in which he proposes to deal with "A Winter's Experience with a Springer Plant."

In addition to the above alluring array of subjects, our gifted Honorary Member, Prof. T. C. Mendenhall, of Terre Haute, Ind., has kindly consented to favor us with a lecture on the "Nature of Light." As the members of our Association ardently desire to absorb all the information that there is to be had on this very subject, it is safe to promise the genial Professor an attentive audience.

There has been a very strong undercurrent of sentiment all drifting in the direction of causing the "Question-Box" to assume a more prominent part in the Cincinnati convention than that hitherto played by this important and useful receptacle. In order that a systematic and comprehensive arrangement and classification of the questions be assured, the members can greatly aid the Secretary should their queries be immediately forwarded to him at Quincy.

To go back a step, it might be well to call attention to the advisability, if not the necessity, that exists for members seeing to it that their rooms in the hotel are secured at a day in advance of the meeting. The Grand is a large hotel, it is true; but as every holder has a limit beyond which it is not safe to go, and as the Western is fast becoming a "big Association," our members should give due heed to the above hint, in order that disappointment as to proper accommodation may not be experienced by any.

While there really seems no occasion to state that our local Committee of Arrangements are working with good will and strong purpose in

their preparations for the Association's entertainment, it gives me pleasure to be able at this early date to furnish the members with a partial list of the good things in store for them. There will of course be a banquet served in the superlative style of the present proprietors of the Grand, carriages are to be at the command of the ladies accompanying the delegates, and other preparations for their entertainment while their escorts are attending the regular business sessions of the Association, are under way. Another feature of the "outing time" will be a steamboat excursion on the Ohio river, the route of which will enable the excursionists to make a visit of inspection to the model East End Station of the Cincinnati Gas Light and Coke Company.

The Western hereby formally extends a most cordial welcome to the Eastern fraternity, and to all others, to be present on the occasion of our Twelfth Annual. Numbers will not interfere with us in the least. In fact, our pleasure and satisfaction will increase in measure with the individual responses, made in person, that shall be our portion from this invitation. We not only earnestly desire, but confidently look forward to meeting this time with a larger delegation from the East than it has been our pleasure to have entertained at any other of our gatherings.

Copies of our by-laws, containing our membership list and application blanks for those who wish to swell the ranks of the "Western," will be mailed by the Secretary to those who desire them.

In accordance with the plan outlined in the last issues of the JOURNAL, to the effect that special arrangements were in process of perfection to enable those who desired to travel in special cars, from Chicago to Cincinnati, on the evening of May 13th, it may be said that those who desire to avail themselves of this programme should purchase tickets by the "Monon route." Fred R. Persons, 75 North Clinton street, Chicago, should be notified of this intention at as early a date as possible, so that provision can be made for the accommodation of all.

A. W. LITTLETON, Secretary.

BRIEFLY TOLD.

THE FINAL GUN FROM QUINCY.—Littleton is standing to his guns quite manfully, for the echo of one report scarcely dies away ere the ringing sound of its follower disturbs the air. Better than all, however, is the fact that Littleton's shots are not most noted for the noise that ushers them in—or out. No; they hit the mark. And this conjures up the thought that the Quincy marksman does not seem to have acquired his knowledge of gunnery, primarily, from initial practice with blank cartridges. From his current circular we learn that another volunteer has joined the list of paper writers. The latest accession, although a volunteer, is not to be regarded as a raw recruit, but must be looked on as a veteran. Mr. Gimper has frequently figured as a contributor to the Association's paper lists, and as what he did say has been well said, we may look forward to a happy repetition, so far as careful treatment and logical conclusion are concerned, of this in his remarks regarding "The Education of the Gas Manager." It is also a new theme for presentation at an Association gathering, and we are pleased that the discussion of it is to be started by so capable an engineer as the man from Leavenworth undoubtedly is. The Secretary's hints as to the likely outcome of the labors of the local Committee of Arrangements are timely and welcome; although we presume that every one settled it for himself in advance that the committee would do everything wisely and well and liberally. In connection with the means for obtaining the reduced railway rates, and those who can avail themselves of the courtesy of the Central Traffic Association are to be congratulated, we herewith reprint the salient points of Secretary Littleton's circular of instruction in respect to securing the concession:

First.—Each person must purchase (not more than three days prior to the date of the meeting nor later than three days after the commencement of the meeting) a first-class ticket (either unlimited or limited) to the place of meeting, for which he will pay the regular tariff fare, and upon request the ticket agent will issue to him a certificate of such purchase (Form 2), properly filled up and signed by said ticket agent.

Second.—If through tickets cannot be procured at the starting point, the person will purchase to the nearest point where such through tickets can be obtained, and there repurchase through to place of meeting, requesting a certificate properly filled out by the agent at the point where repurchase is made.

Third.—Tickets for the return journey will be sold by the ticket agents at the place of meeting at one-third the highest limited fare, only to those holding certificates (Form 2), signed by the ticket agent at point where through ticket to the place of meeting was purchased, and countersigned by the Secretary or clerk of the convention, certifying that the holder has been in attendance upon the convention.

Fourth.—It is absolutely necessary that a certificate be procured, as it indicates that full fare has been paid for the going journey, and that the person is therefore entitled to the excursion fare returning. It will also determine the route via which the ticket for return journey should be sold, and *without it no reduction will be made*, as the rule of the Association is that "No refund of fare can be expected because of failure of the parties to obtain certificates."

Fifth.—Tickets for return journey will be furnished only on certificates procured not more than *three days* before the meeting assembles, nor later than *three days* after the commencement of the meeting, and will be available for continuous passage only; no stop over privileges being allowed on tickets sold at less than full fares. Certificates will not be honored unless presented within *three days* after the date of the adjournment of the convention.

Sixth.—Ticket agents will be instructed that excursion fares will not be available unless the holders of certificates are properly identified, as above described, by the secretary or clerk, on the certificate, which identification includes the statement that fifty or more persons, who have purchased full fare tickets for the going passage, and hold properly receipted certificates, have been in attendance at the meeting.

The certificates are not transferable, and the signature affixed at the starting point, compared with the signature to the receipt, will enable the ticket agent to detect any attempted transfer.

We would also again call attention to the scheme that has been perfected for enabling the delegates who shall go to Cincinnati by way of Chicago on the evening of the 13th. In spite of the trouble which has again beset Fred. R. Persons, that energetic gentleman, or some efficient representative of his, will see to it that the party going by the Monon route will have none but the pleasantest of recollections about the trip. As far as Secretary Littleton's cordial invitation to the fraternity in general is concerned, we can only note that if the sayings of the many gas men up this way "who visit the JOURNAL office" are to be taken for granted, the Eastern delegation that will visit Cincinnati on the occasion of the Western's Twelfth Annual will be a representative one.

IN order that President Ramsdell, of the Western, might be prepared to direct the proceedings with that *curiosa felicitas* which clings to those who have accomplished good deeds, he has paved the way by announcing to the gas consumers of Vincennes that from and after June 1st they are to share in a reduction of 15 per cent. from the rate now paid for the gas consumed by them. The scheme is to leave the gross rate as now, prompt payment (*i. e.*, within 5 days from the presentation of bills) to bring into play the 15 per cent. concession. The new net rates, therefore, will be:

Monthly Consumption.	Net Rate per 1,000.
Under 2,000 cu. ft.	$1.70
" 10,000 "	1.62
" 50,000 "	1.53
Over " "	1.45

This ought to boom the day consumption out in Ramsdell's beautiful city, and we congratulate the Western's President on the fact that he is just as wide awake as ever.

THE St. Louis gas consolidation is not yet an accomplished fact, although there is small room for doubt but that the completion of the affair is merely a question of short time. In connection with certain statements that have recently been circulated as to the real parties in interest in this purchase, we publish, by permission, the following letter, which, however, is more notable for what it contains in respect to those who are not interested rather than for its revealment of those who are:

"H. B. HOLLINS & Co., 18 Wall st., N. Y., April 24, 1889.

"J. D. THOMPSON, ESQ.: Dear Sir—Upon the completion of the consolidation of the Laclede Gas Company and the St. Louis Gas Trust, of the city of St. Louis, Mo., the control of the new organization will rest with ourselves, and it is our desire that you remain in your present capacity of Secretary and Treasurer, or that of Vice-President of the new organization. In this connection we wish to state that the report in the New York papers that the St. Louis Companies will be under the control of the Standard Oil Company people is entirely without foundation, the control resting solely with ourselves. Trusting that this will meet with your views, we are, Yours very truly,

"H. B. HOLLINS & Co."

AT the annual meeting of the Chicago Gas Trust the following officers were chosen: Directors, E. C. Benedict, E. J. Jerzmanowski, H. J. Davison, W. H. Gebhard, C. F. Dieterich, John Sloane, H. Fitzhugh, C. Counselman, S. A. Kent, C. R. Cummings, C. N. Fay, W. L. Elkins, and P. A. B. Widener; Prest., C. N. Fay; V.-Prests., E. C. Benedict and E. J. Jerzmanowski; Sec. and Treas., F. B. Wells. The changes are the replacement of W. W. Gibbs and W. C. Goudy, by Messrs. Dieterich and Sloane; which is interpreted to mean that the Equitable Company of this city—or, rather, those who are interested largely in the same—has increased its holdings in the Chicago Trust's securities. By the way, that promised dividend does not appear to have been declared.

The Dinsmore Process of Gas Making.

The patent issued in England (No. 2,096, Feb. 11, 1888) to J. H. R. Dinsmore, for a process of gas making, is being critically examined by English gas makers, since no little interest attaches to the Dinsmore plans as pursued at the Widnes gas works, where it is said the "Dinsmore Process" is being worked on a large scale with unequivocal success. We herewith reprint from the London *Journal* a clear exposition of the Dinsmore claims and apparatus. The patentee says:

"This invention relates to the manufacture of illuminating gas from coal in closed vessels or retorts; but it relates more particularly to those processes of manufacturing illuminating gas by which it has been proposed to render permanent practically all the heavy or tarry vapors or liquors, as well as the light products given off from coal by distillation, and to make them useful for the production of light and heat.

"My present invention has for its object, amongst other things, (*a*) to convert the tar or tarry liquors or tarry vapors given off from coal in distillation, into permanent gas; (*b*) to effect this object and those above specified by certain modes or methods and apparatus; and (*c*) to carry out these and other objects incident to the process by apparatus in which the ordinary retorts of gas works are rendered available for making gas according to my invention.

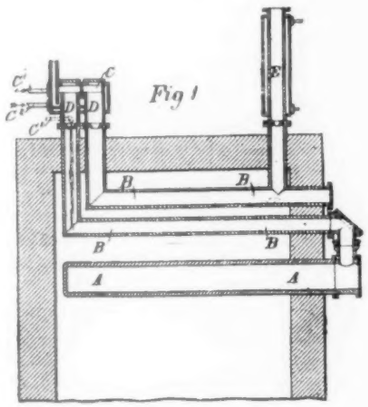
"I will first describe the mode or method by which I convert the tarry products resulting from the distillation of coal in retorts into permanent gas. It is found in the manufacture of gas, whether produced in the ordinary way or in the manner hereafter described, that a certain quantity of tar or tarry products is obtained from the gas when cooled. It is these matters or products which I convert into permanent gas; and the essential feature of this portion of my invention consists in introducing such tar or tarry products into heated chambers, ducts, or vessels, in the presence of gas which is being, or has been, produced from coal used in the retorts. The method may be carried out in various ways, and in various forms of apparatus. For instance, I may carry it out by collecting the tar and tarry liquids in a tar main through which the gas may also pass on its way from the retorts, and conveying them back to the retorts or heated ducts, hereafter described, whereby they would be converted into gas in the presence of the gas passing off from the coal and passing through the chamber, retort, or ducts. In carrying out this part of my invention, the tar or tarry liquor would be conveyed to the heated chamber or ducts at the time most conducive to the best efficiency—that is, while the hydrogen of the coal gas is present, and in such a condition that the gases resulting from the vaporized tar combine with it and form permanent gas.

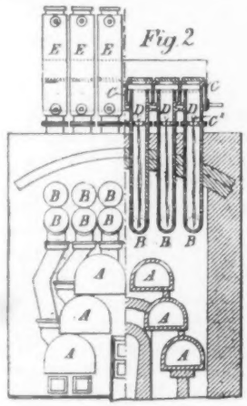
"Under head (*c*), my invention consists in the construction and arrangement of gas making apparatus of the type above specified, by which the retorts at present in use in gas works can be used. In setting forth an example of the application of this head of my invention, I will take and describe it as applied to a bench of single retorts set in the ordinary way. Then, in such an instance, above the nest of retorts and subjected to the heat of the furnace gases, I dispose a number of sets of pipes, through which the gas after leaving the retort is passed. The ordinary existing form of retort mouth and lower length of the ascension pipe may be used when required or suitable; or the retorts may be provided with special mouths and ducts, connecting them with the above-specified heated ducts or pipes. The gas made in the retorts is led from the mouths of the retorts to the heated ducts, and passed through them; and the greater portion of the gas is thereby rendered permanent. The heated ducts may be either plain pipes or they may be provided with cooled passages or surfaces, by which the bulk of the non-permanent and tarry vapors would be arrested and caused to flow back into them, and ultimately converted into permanent gas. It is preferred that each retort should be provided with its own duct or set of ducts.

"It will be seen from the above description that to use the existing retorts of a gas works in apparatus constructed according to this invention, it is only necessary to provide the sets of heated ducts, with or without cooled surfaces or passages, and place them above the retorts as described; the gas made in the retorts being passed through the heated ducts. In some instances it will be necessary to add to the height of the retort bench walls, and to raise the roof; but it is evident that the nature and degree of alteration or addition required will necessarily depend upon the condition under which the invention is to be applied.

"One convenient arrangement of heated ducts provided with cooled surfaces consists of two ducts disposed horizontally, or at an inclination, and having at their rear ends upright parts, which pass through the roof of the bench. At this point, they are provided with a cooling jacket and a chamber, in which the ends of the pipes open. In this chamber tar or tar and water is maintained; and the chamber is so constructed that the gas has to pass through a small depth of liquor on its way from the exit of one pipe to the entrance of the other. This chamber forms a kind of sealed hydraulic main or tar trap—one portion being open to the atmosphere; and into this trap the tarry liquors from the gas main may be led, as above described. They will thereby flow over the lip of the first upright duct (which is the lower of the two) and down it; and so convert it into gas, and go along with the rest. At the exit of the second pipe I may provide a second cooling jacket or surface also vertically placed upon a second upright portion of the pipe. Suitable doors are provided at all points where required for gaining access to the interior of the pipes for cleaning or scraping.

"By the latter construction of ducts, the coal is distilled in a retort and passed through a heated duct, and then is passed through a cooled passage. After this it is again passed through a heated duct; and then finally through a cooled passage. By this means the gas is first subjected to heat after leaving the retort, by which a great portion of the gases in a non-permanent state are made permanent. It is then subjected to cooling influence; and thereby the greater portion of the condensable tarry vapors or gases are arrested by condensation—the tar resulting therefrom, falling into the heated ducts, is reconverted into gas. And, finally, the gases or vapors still existing in the gas are again subjected to a cooling influence; and a portion of the tarry vapors are thereby condensed, and fall into the heated duct, where they are converted into gas."





In the illustrations, *A* is the bench of retorts, set closely together in the ordinary way. *B* are the heated ducts; each retort being provided with a double one. *C* are the chambers, constructed in the form of a trough; and *D* and *E* are cooled passages. In this example, if *A* represents a set of existing retorts, then all that is necessary to do to render the retorts applicable for use in carrying out this invention is to introduce the heated ducts *B*, and apply the chamber or seal trough, and cooled passages; the other details or parts being either retained or others used in their place, as may be required or deemed expedient. The chambers *C* consist of a horizontally arranged trough separated into a number of sub-chambers by partitions. Each chamber is provided with passages *D*; also with a curtain and a cooling jacket at one side and at the bottom. The sealing in the chambers *C*, by which gas is prevented from returning to the retorts when the doors are opened, is effected by curtains, the lower edges of which dip into the tar which lies in the trough between the two pipes forming the passages *D*. There is a curtain to separate the chambers *C* into two parts; one being the

part through which the gases from one of the cooled passages *D* pass from one to the other of the passages *D*; and the other being the part to which the tar return-pipe C^2, and an ammoniacal liquor escape-pipe C^3 is connected, and into which the tar returned from the gas main and condensers may be introduced. The upper part of this portion is open to the atmosphere, as shown; and the lighter liquors which find their way into it are taken away from it by the escape pipe C^3. When the liquid in this outer part rises to a certain height above the lips of the passages *D*, the tar, which will lie at the bottom, will be forced under the edge of the curtain and up into the inner portion of the trough *C*, and so on up to the level of the lip of the passage *D*. When it rises to slightly above this level, it falls over the lip of the passage *D* and down it. In doing so, and before entering the ducts *B*, the tar will have to flow over the point at which the passages are contracted. From this toe the tar drops directly on to the red-hot surfaces of the horizontal portions of the ducts *B*. The lighter liquor from the outer portions of the chamber *D* is (as above described) carried off by a pipe C^1, which may be trapped, and the level of which with respect to the chamber *C* is determined. The exit passage *E* is maintained in a cool condition of water jackets. The passage is also provided with a toe by which matters condensed within it, in falling towards the ducts *B*, are caused to fall directly from the toe on to the red-hot portion on the bottom of the duct *B*. All cooling jackets are provided with suitable water-circulating inlet and outlet pipes.

In lieu of introducing the tar into the ducts *B*, in the manner just described, it may be returned from the mains, condensers, or other parts of the apparatus, and introduced by the pipes shown in dotted lines, passed into the passages *D*, and provided with a delivery orifice arranged in such a manner that the tar will fall directly from the orifice on to the bottom of the ducts which will be red hot.

In all cases the supply of tar to the duct *B* must be a regulated one, whether such supply to the duct be direct or indirect; and little or no more tar than is capable of being gasified by the duct must be supplied to it—that is to say, the quantity of tar must be regulated in such a manner that the temperature at the surface of the duct *B*, in or on to which the tar falls, will not be thereby reduced below an efficient gasifying point (say, a bright cherry-red color).

As to the proportion of ducts or retorts, and the quantity of tar produced from the coal distilled in such retorts that may be introduced into the ducts, it may be said that as the size and amount of heated duct surface used and caused to act on the tar in a bench of apparatus is to the size and number of distillatory retorts or the quantity and quality of the coal distilled in the retorts and the quantity of tar produced from such coal, so will be the quantity of tar capable of being vaporized or gasified by the duct surface, to the quantity produced.

The operation and process of manufacturing gas are as follows: The coal is placed in the retorts *A*, and distilled by heat in the ordinary way; and the gas evolved from the coal is passed in to the lower hot duct *B*, of each retort, by its ascension-pipe, the cooled passage *D*, etc., into its trough or chamber *C*. In this passage and chamber it deposits part of its tar and condensable matters, such as ammoniacal vapors. It then passes under the sealing curtain, and down through the second artificially-cooled passage *D*, into the upper of the heated ducts *B*. It leaves this duct by the cooled passage *E*, wherein a further quantity of tar and other condensable matter is arrested or condensed. In the condition in which the gas enters the lower of the ducts *B*, a portion of it is not permanent; but in passing through the duct the whole is subjected to the heat of it, and the greater part of the non-permanent portion is thereby rendered permanent. The tar deposited from the gas in the chambers *C*, and the tar and other liquors condensed in the passage *D*, together with the tar introduced, all fall down to the bottom of the ducts *B*, where they are gasified by the heat of the duct, and in the presence of the gas passing through such duct. The matters condensed in the cooled passage *E*, fall, as described, into the duct *B*, and are gasified in the presence of the coal gas passing through such duct.

After the gas leaves the distilling apparatus illustrated, it may be conducted through a considerable length of inclined pipe, as commonly practiced, before delivery to the condensing and washing apparatus; and in traversing the pipe a certain quantity of tar will be removed from the gas. This tar, as above stated, together with the tar recovered by the condensers, is brought back to the distilling apparatus by gravity or otherwise, and introduced into the hot ducts *B*, to be there gasified in the presence of freshly-distilled gas coming from the retorts *A*, so converting it into permanent illuminating gas.

Several modifications of the various details of the invention are described and illustrated in the specifications.

There are in all 27 claims for the invention, concerning which the patentee says: "Although I have particularly described special examples of apparatus for, and methods of producing illuminating gas in them, nevertheless, I do not bind or confine myself to the special forms of construction of the apparatus or parts thereof described; for it will be evident to those skilled in the art of manufacturing gas and making gas manufacturing apparatus, the several details or parts of the apparatus set forth and illustrated, and the exact arrangement or disposition of them as well as their forms, may be varied without departing from the nature, spirit or scope of the invention; and further, that various combinations of parts of the several arrangements herein illustrated may be made and used to carry out this invention. Moreover, I do not confine or restrict myself to any particular quantities of tar that may be introduced and gasified in the apparatus; nor the particular point or points at which its introduction into the apparatus may be made, or means by which it is introduced, or the precise mode of mixing the tar, gas or vapor with the coal gas, or the part of the apparatus at which it is combined with the coal gas, as these may be, and will be varied, under varying conditions and requirements to suit such conditions or requirements. On the other hand, I wish it to be understood I do not claim the application and use generally as separate things, of a heated chamber, duct, or ducts in connection with coal-distilling retorts, or cooling passages, or broadly the making of gas from tar which has been condensed from the gas made in the apparatus, as these features, as separate things, have been heretofore proposed." What he primarily claims, however, is: "In the manufacture of illuminating gas, the herein described method of making illuminating gas from the tar condensed or recovered from gas made in the gas making apparatus, which method consists in causing the tar to be delivered into or to fall on to the red-hot surface of, or a red-hot surface within a heated chamber, or duct, or ducts in the presence of freshly-distilled gas, or through which such gas is being passed."

The Eiffel Tower.

The *Vossiche Zeitung* explains that the monstrous tower designed by Engineer Eiffel for the Paris Exposition has three stories or divisions. The first story is 60 meters high (a meter is equal to 39 inches) and rests on the arches which join the four foundation columns that carry upon them the entire weight of the huge tower.

The tower has four distinct sections. Each wing is provided with a refreshment saloon that may be reached by means of winding staircases under the foundation piers. Notwithstanding the center of the space has been set apart for the elevator, there still remain 4,200 square meters of floor room for the accommodation of visitors who may desire to promenade and enjoy a view of the city from that height.

The apartments are very roomy, and precautions have been taken to insure the visitors against all possibility of accident. An iron railing, about 4 feet high, with an arched roof to exclude the intense rays of the sun, surrounds the extreme edge of the platform, as it may be called, which has been reserved as a promenade for those who desire to walk about. The requirements for the comfort of the inner man, too, have not been forgotten. Kitchens, storerooms, ice chests and the like have been fitted up in the most handy manner imaginable, so that there is little occasion to fear that the supply of stimulating refreshments will give out, even in the days when such lodgings in the hotels and private houses will not be obtainable for love or money. Each one of the four cafes is provided with a cellar capable of storing 200 tons of wine.

Everything about the structure is absolutely fireproof, for iron is the only material that has been used in its construction. Two thousand persons per hour can ascend and descend the staircases leading to the platform, and 4,000 can find seats to rest upon in the cafes at one time.

The second story, which is 60 meters above the first one, is also reached by four staircases built inside of the supporting columns, which make a sharp inward curve, leaving but 1,400 square meters of surface for the platform and promenade. Here, too, in the commodious and handsomely-decorated cafe the thirsty and tired sightseer may find something more potent than Seine water to recuperate his strength.

This story is 91 meters above the tip of the Notre Dame steeple, and higher than the tower of the palace of the Trocadero, on the other side of the river, and, as may easily be imagined, the view of the surrounding country to be had from such an altitude is almost indescribable. From here on the columns of the tower fall in towards each other until they ascend a distance of 275 meters above the ground, where the third and last story is situated.

Only one staircase leads to the third story, which is for the exclusive use of the persons employed in the tower, and all visitors are expected to use the elevators, two in number, to reach that point. The platform is

18 meters square, still large enough to erect thereon a comfortably-sized dwelling. The view here is simply superb. The story is equipped with reflecting mirrors and a large supply of field glasses for those who wish to use them. It has been estimated that the ordinary eye can discern objects 70 miles away.

The tower terminates in what is known as the lantern, 25 meters above the third section, but this place has been set aside for the use of the scientists for making observations.

How the Sale of Gas for Other than Illuminating Purposes is Fostered by the Government of Dusseldorf.

The *Journal de l'Eclairage du Gaz* is our authority for saying that the original manifesto issued by the Government of Dusseldorf to the various local governing powers of the district (the gas works in which are for the most part operated by the municipalities) respecting the employment of gas as a motive power, is about as follows :

The use of cheap motors is of great importance for the maintenance and improvement of the position of those engaged in small industries. In several trades, workmen and small manufacturers cannot contend with their competitors who are provided with machinery, and measures must therefore be taken to alter this state of affairs. Of all the numerous motors invented during the last ten years gas motors have proved the most useful. They run without noise, are always ready to be set in action, do not consume fuel when not working, and can be placed at any level. In large factories where machines are driven throughout the entire working day, power can be more economically obtained by means of steam, but for small industries in which motive power is only required intermittently, gas motors are undoubtedly preferable. We are in possession of information which enables us to state that in this district 333 gas motors are already employed, using the gas from the public offices. It is probable that the number is greater, but in any case it is well established that there is a considerable increase. Out of thirty-three public gas offices in the district fifteen have agreed to supply gas for motive power at lower prices than for illuminating purposes.

We include in these public offices not only those belonging to the various townships, but also those owned by companies and by private individuals which supply illuminating gas. This fall in the price of gas for motive power has been still further modified by certain towns, such as Wermelskirchen, Remscheid, Duisbourg, and Dusseldorf, with the expressed and avowed purpose of assisting the small manufacturers. Other towns, such as Crefeld, Mont-Gladbach, and Mulheim-on-the-Ruhr, where private gas works exist, have accepted these alterations simply as a matter of pure business.

According to a calculation, which we have reason to believe is reliable, gas for motors could be supplied at two thirds the price charged for illuminating gas The consumption of gas for motors is the same in summer as in winter, and does not vary from day to day, while that of illuminating gas varies on the different evenings of the week, and is much greater in winter than summer. A works which produces gas for motive power can be conducted with fewer retorts, and requires smaller apparatus and fewer workmen than one supplying an equal quantity of illuminating gas. The latter requires in winter, the period of maximum consumption, more retorts, more extensive plant, and more hands. Most works are so arranged as to be able to furnish their maximum of gas without laying down fresh plant. Interest on invested capital and expenses of maintenance remain invariable throughout the year, whether the production of gas be great or small. Similarly the number of hands employed does not increase in proportion to the production of gas. The greater the production of gas the less becomes its net cost. The sale increases as the price is lowered.

In consideration of the keen competition of the electric light, it is of great importance for the suppliers of gas to ensure customers who employ gas for motive power and not for lighting, in case the electric light should by some new discovery be rendered cheaper than gas.

The statement which follows, compiled from special information, gives the price of illuminating gas without deducting the discount allowed to large consumers, and the price of gas for motive power, together with number and power of the motors in use, for 33 gas companies in the district. More than half of these companies allow discount to large consumers. We believe that this is justifiable when the object is to prevent large consumers from establishing private gas works, or from having recourse to other sources of motive power. It can never be advantageous for a Local Board to favor any one.

In any case we do not consider it to be good policy to sell illuminating gas to large consumers at a lower price than is paid for gas for motors. The limit to which the price of gas to be used for obtaining motive power can be decreased varies in the different works. We believe, however, that 10 centimes per cubic meter is a reasonable price. The price of illuminating gas itself varies from 40 centimes in Langenberg to 15 centimes at Wermelskirchen. This difference of price does not arise from the net cost or cost of manufacture, but must in great part be attributed to the tendency towards applying the profits arising from the gas office to the relief of some less successful branch.

The actual prices for illuminating gas, without deduction of discount, are in ten works, most of them small, upwards of 22.5 centimes per cubic metre; in three works, less than 18.75 centimes. The remaining twenty charge between 22.5 and 18.75 centimes. The net cost, comprising interest on the invested capital, etc., amounts, for the municipal works at Dusseldorf, to 10 centimes per cubic metre, and for the works at Wermelskirchen to 15 centimes. In general the net cost amounts from 10 to 15 centimes per cubic metre, according to the amount supplied by the various works. There are but few works in this district at which the net cost exceeds 15 centimes. Starting from the principle that the cost of gas for motive power is one-third lower than that of illuminating gas, it follows that the greater number of the works of the district could, without running any risk of diminishing their receipts, lower the price of gas for motive power to 10 centimes per cubic metre. Wermelskirchen has already adopted this plan, and Cologne has also followed it, fixing the prices of gas for motors at 10 centimes per cubic metre.

The town of Duisbourg has recently fixed the price of gas for motors at 10 centimes in a minimum consumption of 50,000 cubic metres. Thanks to this reduction, the sale of gas has largely increased, the profit thus derived far surpassing the amount of the dimnution granted.

The town of Remschied modified the price of gas for motors on April 1, 1888, by reducing it from 21.25 to 15 centimes. Since that date 15 motors of 20-horse power have been brought into use. In Dusseldorf the price of gas for motive power, and for industrial and domestic heating purposes was reduced, on April 1, 1884, from 22.5 to 15 centimes, and since that time the consumption for these special purposes has increased from 40,000 or 50,000 cubic metres annually to 121,232 in 1885, and 143,509 in 1886. Districts which own gas works are thus in a position which enables them, without financial sacrifice, by lowering the price of gas for motors to 10 centimes, to afford great assistance to their small industries, permitting those thus engaged to acquire economical motors, and thus raising them to a position suited to their importance. Other companies owning gas works will, in a similar manner, increase their receipts by diminishing the selling price of gas for motors by one-third.

The diminution of the price of heating gas is not less to be advised. The offices of Dusseldorf and Duisbourg supply gas for heating purposes at the same price as gas for motive power. These two towns have voted sums of money for the purchase of the best apparatus for the various applications of gas as a heating agent, and lend them for a fixed rent. The gas office of this town hires out gas cooking stoves of three different sizes at 1 f. 80c. and 2 f. 80c. per month. It grants to the hirer the right of purchase at the end of two years, two-thirds of the hire paid being deducted from the price. The office at Wermelskirchen, opened on December 1, 1884, which supplies gas at 15 centimes, bought at the commencement of the summer of 1884 twelve cooking stoves on a new model, and hired them out for the entire summer. These apparatus have been so well appreciated that numerous orders have come in.

A similar arrangement for the kitchen, with two fires, suffices for an average family, and costs 22 f. 50c. The cost of heating is 12 to 15 centimes per diem, and is no greater than with coal.

These cooking apparatus do not cause dirt, cook quickly, and do not send much heat into the room, this being specially desirable in summer. In order to obviate the necessity of a new gas meter, the price of gas for heating purposes has been fixed in Wermelskirchen at the same amount as that of illuminating gas, but it is proposed to reduce it to that of gas for motors; there is thus the same consumption in summer as in winter. Public gas works have the same financial interest in lowering the price of gas for heating purposes as they had in reducing that of motor gas.

Although this diminution in price has not the same special importance for petty industries as the one previously considered, it will none the less prove a great advantage for middle-class households and workmen. A praiseworthy object is set before the local gas officers—to obtain improved appliances for heating and cooking, which might be done by offering special prizes. If the offices themselves purchased the rights to such apparatus, at all events to commence with, the dissemination of these makes would be greatly increased.

We request you, sir, to communicate this note to the public gas offices

of your district, and to do all that lies in your power to obtain a reduction in the price of gas to be employed for the production of motive power and for industrial and domestic heating purposes.

Fireproof Floors.

[A paper read before the English Society of Engineers, by Mr. G. M. Lawford, M. Inst. C.E.]

The subject of fireproof flooring is apparently of great antiquity, for the Romans in the time of Julius Cæsar were in the habit of making their floors and roofs, as well as their walls, of concrete. From an article in vol. li. of *Archæologia*, in the possession of the Society of Antiquaries, it appears that large beds of pozzolana existed over the area of the Campagna. This substance, as is well known, when mixed with lime, forms a natural hydraulic cement of great cohesive power. The lime employed was obtained by burning "travertine" (lapis Tiburtinus), and the other ingredients of the concrete usually consisted of broken lumps of tufa for walls and ordinary foundations; of broken lava when foundations of great strength were required; and of lumps of broken pumice for arched roofs and vaults where lightness was essential. The floors were constructed of large slabs of concrete resting on sleeper walls of brick 2 ft. 9 in. high and about 14 in. thick, set in clay, and placed about 3 ft. apart; a layer of finer concrete was spread over the slab, and Mosaic paving was bedded thereon. The roofs were made flat, and supported on brick pillars. It is apparently a matter of question whether flat centering was used, or concrete slabs in the manner described.

Coming nearer to our own times, up to the middle of the eighteenth century fireproof flooring seemed to consist only of the brick arch, with its accompanying disadvantages of enormously thick walls and great cost; but, towards the close of that century, cast iron girders and segmental brick arches were gradually coming into use for warehouses and floors where strength was essential.

In 1778 Earl Stanhope, in a paper read before the Royal Society, described his invention of pugging for rendering wooden floors fireproof; but this had, in a way, been preceded by the floors used in Nottingham and the surrounding districts in the seventeenth century, formed entirely of bundles of reeds, covered with a thick layer of coarse gauged gypsum, and plastered below with the same material. In Earl Stanhope's floor fillets were nailed to the joists at about one-third of the height, laths were laid on the fillets, and plastered above and below with a mixture of lime plaster and chopped hay; a liquid grout was run over both sides, covering the fillets and forming a fire and air proof slab. The undersides of the joists were then lathed and plastered to form the ceiling. About 1820, wrought iron joists began to take the place of the cast iron girders, and the arch was reduced to a single half-brick ring, concreted over the haunches. This was followed by a concrete floor, designed by a Dr. Fox, of Bristol, about 1830, in which wooden fillets were laid on the lower flanges of rolled joists and concreted over. This floor, known as the "Fox and Barrett" floor, was the subject of a paper read before the Institution of Civil Engineers by Mr. Barrett in 1849; and here it may be remarked that, although the subject is common ground to both engineers and architects, an interval of 40 years has been allowed to elapse without the subject being reopened before the Institution, while the present paper is the first on the subject that has been read before the Society of Engineers.

A description of the "Fox and Barrett" floor will be given later; but it should be observed that this floor was the first in which an attempt was made to protect the exposed faces of the iron joists with a fire resisting material.

In 1845 the late Sir Henry Hunt brought in a system of arching in which the arch was composed of tiles and cement resting on rolled joists. In 1862 Messrs. Measures introduced an improved modification of the "Fox and Barret" floor, known as Phillips' floor, in which tee-iron bearers, 9 in. apart, were substituted for the wooden fillets, and this was followed by the different developments and applications of wrought iron and concrete now in general use.

The objects of fireproof flooring are:

To render each floor capable of resisting the effects of fire, and by so doing to divide the building into a series of compartments, so that fire can neither be communicated from one compartment to another, nor from one story to another; and by making the roof fireproof in addition, to prevent fire from spreading from one compartment to another through the roof burning away.

To gain strength, and in so doing to avoid as far as possible lateral thrust on the walls, and, by making the floor in one homogeneous mass, to distribute the weight equally over them.

To render the floors soundproof, as well as fireproof.

And to secure the building from the attacks and effects of both dry rot and damp.

The systems now most in use in English practice appear to be:

(1.) The concrete arch floor.
(2.) The flat, or suspended, concrete floor.
(3.) The arch block or American floor.
(4.) The flat brick or French floor.
(5.) The solid wooden floor.

The following systems are described in detail as examples of the different types of construction:

Messrs. Dennett's and Wilkinson's representing the concrete arch floor; Messrs. Dawnay's, Lindsay's, and Gardner's representing the flat concrete floor. Messrs. Doulton's (the Doulton-Peto), representing the arch block, or American floors. Messrs. Homan & Rodgers representing the flat brick, or French floor; and Messrs. Evans & Swain's, representing the solid wooden floor.

Taking them in the order given the inventors of the "Dennett fireproof construction" rely for the resistance to fire offered by their system on the properties of sulphate of lime (gypsum). Ordinary limestone cements, when exposed to the action of fire, lose their cohesive power, and tend to fly, thus resembling the original carbonate; but experiments have proved that sulphate of lime loses little of its cohesion by calcination, and that it will remain intact even when exposed to a white heat, and to the application of cold water while in that state, though it is necessarily considerably weakened; in fact, it may be said to resemble timber under the action of fire. The outside, becoming charred, serves as a protection to the inside.

The system consists of concrete arches supported by walls for narrow spans, and by rolled joists for wider spans. The concrete is composed of broken brick and sulphate of lime. The arches are given a minimum rise of 1 in. to every foot of width up to spans of 10 ft. The concrete can either be filled in solid over the haunches, to form a floor of the same material throughout, or arranged to carry a wooden floor, as the building requires. Where columns and main girders are required, both are completely encased in the concrete, while the ceilings can either be plastered, or ceiling joists can be placed on the lower flanges of the joists and lathed and plastered.

From the slight rise given to the arches, the thrust on the outer walls is reduced to a minimum.

This floor can be laid as a flat floor, if required, but the usual construction is that of the arch.

The concrete of which these floors are composed is a non-conductor of both sound and heat. As an instance of its great strength, on one occasion, when a building was being erected, a scaffold pole fell vertically from a great height on to an arch of this concrete and knocked a hole through it exactly the size of the pole. The minutest examination failed to discover anything approaching a fracture or crack either in the concrete immediately surrounding the hole or at any other point in the arch.

The long list of buildings in which the Dennett construction has been adopted shows the high opinion in which it is held. Mention may be made of the Home, Colonial, and Foreign Offices, the National Gallery, St. Thomas's Hospital, the Law Courts in London and Birmingham, and the Imperial Institute.

The cost of this floor, for a 12 ft. bearing and 10 ft. span of arch, inclusive of joists, is 9s. 3d. per square yard; the weight, 54 lbs. per square foot; and the safe load, 2 cwt. per square foot.

Messrs. W. B. Wilkinson & Co. have two systems for fireproof floors—one of concrete arches, similar to the Dennett construction; and the other a protection to wooden flooring, consisting of fibrous plaster slabs laid as pugging between joists, and thinner ceiling slabs of the same material.

Referring to the first system: the concrete of which the arches are made is composed of bricks broken to 1½-inch gauge, coke breeze, and Portland cement. The form of arch is similar to the Dennett construction; main girders and columns, when used, are covered with Wilkinson's fibrous plaster (described later).

The floors can be finished entirely in concrete, or arranged for wood, tile, or other paving.

For landings, corridors, and similar small spans no joists are required, the concrete being laid on flat centering; additional strength is given by the insertion of tee-irons, 2 ft. 6 in. apart, in the concrete.

Ceilings can either be finished off with plaster, or laid with ceiling joists, to which are nailed fibrous plaster ceiling-slabs, ¼ in. thick.

This system has been used at Edinburgh University, at several stations on the Northeastern Railway, by the War Department, and in many warehouses and stables.

The cost of this floor for a 12 ft. bearing and 10 ft. span of arch, inclusive of joists, is 7s. 6d. per square yard; the weight, 52 pounds per square foot; and the safe load, 2 cwt. per square foot.

The second system is suitable for dwelling houses, offices, etc., and has the additional advantage that it can be adapted to any existing wooden floor.

In construction it is similar to the pugging invented by Earl Stanhope, and described previously; slabs of fibrous plaster pugging are nailed to wooden angle fillets on the joists, and a triangular plaster fillet is then run along the slab against the joist. The floor is boarded over in the usual way, while the ceiling consists of fibrous plaster ceiling slabs nailed to the joists; all joints are carefully plastered, and a series of air-tight compartments is thus produced. The slabs for both pugging and ceiling are made of coke breeze and plaster on a basis of cocoanut fiber; they are non-inflammable, and by reason of their lightness are specially adapted for wooden floors, as the walls can be of the usual thickness, while concrete floors must be supported by much stronger walls.

The cost of pugging and ceiling is about 5s. per square yard, exclusive of timber construction.

Mr. A. D. Dawnay is one of the pioneers of the flat or suspended concrete floor. His system consists either of ½-inch square iron bars, 12 inches apart, or of small 3-inch joists, 16 inches apart, resting on the lower flanges of 5-inch binding joists in 7 foot bays. This construction is suitable for spans up to 20 feet wide, the binding joists being strengthened according to the increase of span.

Flat centering is placed below the joints, and concrete is filled in, forming one solid mass completely encasing the ironwork. The concrete is composed entirely of broken brick—crushed firebrick preferred—and Portland cement. The joists are protected with a minimum depth of 1½ inch of concrete. Any floor can be laid on the concrete, while the ceiling can either be floated or plastered.

The chief advantage lies in the fact that this floor is composed of a solid block of one material throughout, absolutely indestructible, of great strength, and of the simplest type of construction.

Mr. Dawnay's system has been used in over 3,000 buildings, amongst others Charing Cross Hotel, the Colonial Institute, Exeter Hall, the Gaiety Theater and Restaurant, London and County Bank (head office and branches), several Board Schools, Salvage Corps and Fire Brigade stations.

The cost of this floor for a 12-foot bearing, including joists, is 7s. per square yard, the weight 40 pounds per square foot, and the safe load 2 cwt. per square foot.

Messrs. W. H. Lindsay & Co., of Paddington, also use the flat construction. The joists are spaced from 18 inches to 30 inches apart, additional strength being given to both concrete and joists by means of trussed rods. These are placed in pairs on the joists about 18 inches apart, and pass over and under them, thus having the effect of bracing on the joists. The ends of the rods are bent over to form a clip on the flange of the joist.

One great advantage claimed for these rods by the inventor is that if any portions of the concrete give way under fire, the rods keep the whole slab from falling, and the damaged parts can afterwards be cut away and made good.

The concrete used is Lindsay's patent pumice concrete, consisting of coke breeze, mineral sand and Portland cement. It weighs 80 pounds per foot cube as against 112 pounds for ballast concrete, and 100 pounds for brick concrete, and materially lightens the weight of the whole floor. The floor and ceiling can be finished in any of the usual methods. The cost of this floor for 12-foot bearing, including joists, is 7s. per square yard, the weight 44 pounds per square foot, and the safe load 2 cwt. per square foot.

Messrs. Lindsay & Co. have another system of fireproof flooring for use where greater strength is required. The patentees' steel floor troughs are used and filled with pumice concrete, the underside being protected either by a lath and plaster ceiling secured to fillets bolted to the troughs, or by pumice concrete slabs suspended in the same way.

The flooring is considerably more expensive, and a great disadvantage lies in the fact that the whole surface, though sheathed, is practically a sheet of metal, and therefore would be sooner affected by fire than the other system.

These floors have been used in the National Liberal Club, the Prudential Assurance Company's offices, Holborn, in several blocks of artisans' dwellings, warehouses, offices, and mansions.

Messrs. Gardner, Anderson & Clarke's system is practically Lindsay's floor with the trussed rods omitted, the concrete used consisting entirely of coke breeze and Portland cement. The joists are spaced out, flat centering is slung to them, and concrete filled in to a depth of 1 in. below the joist and 1 in. above the top flange. The joists are thus completely embedded in a non-conducting material. This floor, owing to its light construction, has been largely used for shops with dwellings above.

The cost of this floor, for a 12 ft. bearing, including joists, is 7s. per square yard, the weight 46 lbs. per square foot, and the safe load 2 cwt. per square foot.

The Doulton-Peto floor is of arch construction, but the arch is perfectly flat, consisting of a series of terra-cotta blocks completely encasing the joists or girders. It is composed of springers or skewbacks resting on and overlapping the lower flange, and of a wedge-shaped key block, the intervening blocks being rhomboids.

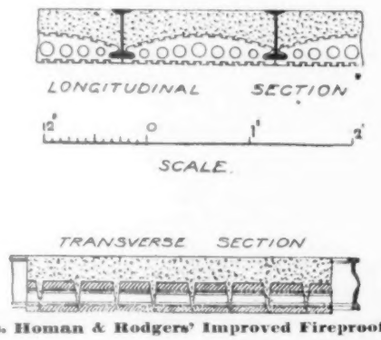
The blocks are composed of a mixture of clay and terra-cotta, and are moulded with dovetail grooves on the lower surface, to afford a key for plaster. The material of which the blocks are made does not crack either under heat or from the effects of cold water during heat, while the joist or girder is completely covered with the same material, which is a great non-conductor of heat, and on this account has been used for Turkish baths.

It must, however, be borne in mind that there is a considerable amount of thrust, involving the use of stronger walls, while a layer of concrete or dry filling has to be added to complete it, and from the nature of the construction, the spans cannot exceed 6 ft. without increasing the depth.

It has been used at Whiteley's, the London Pavilion, the National Provincial Bank, head office, and in several warehouses.

The cost of a 6 ft. floor, for a 12 ft. bearing and 6 ft. span of arch, inclusive of joists, is 9s. per square yard, the weight 34 lbs. per square foot, and the safe load 2 cwt. per square foot.

The Homan & Rodgers floor is an application of the French, or flat brick floor; the arch construction is avoided, and the flooring, being a dead weight, serves to tie and strengthen the walls. The system consists of rolled joists, placed 3 ft. 6. in. apart. Resting on the lower flanges of the joists, tee-iron bearers are laid 12 in. apart, the ends being



Messrs. Homan & Rodgers' Improved Fireproof Floor.

bent up so that the undersides of the joists and tee-irons are on the same level. Specially-moulded hard-burnt bricks are then laid on the tee-irons. These bricks are of gault clay, and are perforated for lightness; they are 12 inches long, 4½ wide, tapering to 3 inches, and 2½ inches deep, and are made with wedge-joints longitudinally and dovetail-joints transversely, as shown in the diagram; they are moulded with longitudinal dovetail grooves on both surfaces to afford a grip for the concrete and a key for the plaster. A depth of 2½ inches of coke breeze concrete is laid over the bricks; this fills up the wedge-joints and binds the whole into a solid mass.

The soffit is then plastered, the grooves on the bricks forming a sufficient key to carry the plaster under the joists and tee-iron bearers, thus covering all exposed surfaces of the iron work.

The floor can be finished as required. The bricks are not affected by heat, and are protected from the effects of water by the concrete above and the plaster below.

The floor is practically noiseless, the different densities of the brick, concrete and plaster intercepting the sound vibrations.

An additional advantage is in the diminished depth of the floor, owing to the absence of the arch.

These floors have been used by the London School Board, and in the General Post Office, the People's Palace, and several large blocks of mansions and warehouses.

The cost of this floor, for a 12-foot bearing, including joists, is 7s. per square yard, the weight, 35 pounds per square foot, and the safe load 2 cwt. per square foot.

Since this paper was written Messrs. Homan & Rodgers have produced an improved modification of their system, in which the tee-irons and flat bricks are superseded by hog-backed bricks 18 in. long, reaching from joist to joist, and clipping the lower flanges. These bricks are of the same transverse section as those used in the first system, but are hog-backed longitudinally, with rounded ends recessed to receive the joists, and perforated transversely for lightness. Both surfaces have similar dovetailed grooves. The floor is finished with breeze concrete up to the level of the joists.

This system is certainly an advance on that last described, as the tee-irons are dispensed with entirely, and the joists, though closer together, are protected by the jaws of the bricks.

The cost of this floor, for a 12 ft. bearing, is 6s. 6d. per square yard, and the weight 32 lbs. per square foot.

Messrs. Evans & Swain's fireproof construction depends on the known resistance offered to fire by solid timber. It is a well-known fact that, where flames are not able to play round timber or attack it at the ends, it will offer a very great resistance to the action of fire, and that, after it becomes charred to a certain depth, the charcoal formed on its surface becomes its protection, charcoal being a non-conductor of heat.

It is also a well-known fact that common plaster offers great resistance to fire, and upon the application of these two facts depends the success of this system, for which the inventors claim strength, simplicity of construction, and perfect resistance to fire. An additional claim also deserves recognition—namely, that floors constructed on this system, being homogeneous throughout, the whole weight is a dead weight, and consequently there is no thrust on the walls.

The flooring consists of solid wooden joists of uniform depth and thickness, closely laid, without any intervening space whatever, and spiked together; the spikes should be driven about 18 in. apart, and placed as in chain riveting. It is preferable to bore holes for the spikes to prevent splitting.

The depth of the joists varies from 4½ in. in spans of 8 ft. to 11 in. in spans of 30 ft. The ends of the joists bear on the walls in the usual way, only no plates are required.

All cracks or shrinkages on the upper surface are filled up with a grouting of liquid plaster, while the ceiling can be formed either by nailing the laths direct to the joists or to fillets on the joists, or the lathing can be dispensed with by grooving the under sides of the joists to form a series of dovetails, which afford a key, and the ceiling can then be plastered.

As an additional protection the joists can be tongued, but this, of course, adds to the expense.

The upper surface of the floor can either be left rough, boarded, or floated and finished as a tile or concrete floor, but a layer of hairfelt on which floor-boards are laid serves not only to deaden sound but also increases resistance to fire.

An excellent feature of this flooring is that it dispenses entirely with the use of iron, the action of which under fire is well known.

Owing to its great strength it has been largely used for dock and railway warehouses, amongst others the recently completed warehouses in Commercial-road E., for the London, Tilbury & Southend Railway Company, and for warehouses at the East and West India Docks, while it is now being used in the additions to Westminster Hall.

The cost of a 5½ in. floor, for a 12 ft. bearing, is 10s. 6d. per square yard, the weight 20 lbs. per square foot, and the safe load 7 cwt. per square foot.

A table giving approximately the relative cost, weight, and safe load of a floor 12 ft. span, in the different systems, is appended.

Table Giving Approximately the Relative Cost, Weight, and Safe Load of a Floor, 12 Feet Bearing, in the Different Systems Described in Detail.

Arch Construction.	Cost per Sq. Yard.		Cost per Sq. Foot.		Safe Load per Sq. Foot.	Length of Arch.	Span.
	Exclusive of Joists.	Inclusive of Joists.	Exclusive of Joists.	Inclusive of Joists.			
	s. d.	s. d.	Pounds.	Pounds.	Cwt.	Feet.	Feet.
Dennett	6 9	9 3	50	54	2	12	10
Doulton	6 6	9 0	30	34	2	12	6
Wilkinson	6 0	7 6	50	52	2	12	10
Flat Construction.						Bearing.	
Dawnay	.....	7 0	.....	40	2	12	Immaterial.
Gardner	.....	7 0	.....	46	2	12	"
Homan & Rodgers	.....	7 0	.....	35	2	12	"
Lindsay	.....	7 0	.....	44	2	12	"
Evans & Swain (no joists required)	10s. 6d.		20 pounds.		7	12	"

(To be continued.)

Proposed Corner in Wood Naphtha.

The English *Chemical Trade Journal* says that owing to the unremunerative condition of trade in nearly all the products of wood distillation, and the low price at which the miscible naphtha, 60° over proof, has been selling for some time past, a proposal has emanated from a certain firm of operators in this article, to form an association for the object of artificially stimulating the price. This naphtha is used mainly by the makers of methylated spirit in accordance with excise requirements, and the consumption has a very definite limit. The total production of British manufacture is considerably below the quantity that is required for this purpose, but of late years considerable quantities have been imported from the Continent and from America, and a surplus beyond requirements has from time to time occurred whenever the prices in this country, or the general demand for the other products of wood distillation have been such as to encourage larger output and an increase in the importation. The scheme set forth by the advocates of this association provides that all the naphtha produced in this country and elsewhere shall pass through the hands of the firm of operators alluded to, and that they shall sacrifice the surplus supply, and apportion the loss incurred in such sacrifice among the members of the ring. If it were a fact that the control of the world's production could possibly be compassed by a single firm, then it might be fair to assume that prices could be manipulated to an unlimited extent—but such single control of this article is absolutely impossible—and the proposal to artificially raise prices upon a theory of this kind is not less absurd than it appeared to be some years ago, when a meeting of the trade was held in Swansea, and similar proposals were then discussed and rejected. In fact a control of this kind is less possible to-day than it was then—and there are those in the trade sufficiently enlightened to know that the artificial raising of price is simply to invite the opposition of consumers, who will give their support to any merchant outside of the ring, while a stimulus would be given throughout the whole trade to increase production just at a time when it is necessary that it should be curtailed. The remedy for the present low values and unremunerative state of the whole trade lies in the inevitable curtailment of production, both at home and abroad, which will bring about a proper balance between supply and demand, and under these conditions the price of naphtha will rise again to a reasonable limit, as it has done before under similar circumstances, without artificial means.

Central Station Lighting.

By Prof. Geo. Forbes.

[Abstract of a paper read before the London Institution of Electrical Engineers.]

It is the universal practice abroad to make the size of the feeders such that the loss of pressure in these feeders is the same in all. This involves the use of very large feeders when their length is great, and great waste of energy when the length of the feeder is small, but it enables all the feeders to be supplied by dynamos at the same pressure, which may therefore work in parallel. This arrangement is simple to work, but it is wasteful. I find that we can save enormously in copper at a slight extra trouble in working the central station. I would prefer to see the feeders divided into two or three groups, feeders in each group having the same length and having the same loss of pressure. All these feeders would be made of the economical section, according to Sir William Thomson's law. When the station is at full load, the dynamos working long feeders have a higher pressure than those working short feeders. When the load is light all the dynamos would work at the same pressure, because the loss in the feeders is insignificant. At such times all the dynamos might be joined in parallel, or the feeders might all be upon one dynamo.

Position of Pilot Wires.—In nearly all cases of low pressure distribution the pressure is regulated by a "pilot wire" coming from the point where the feeder meets the main. These pilot wires indicate the pressure at those points upon a voltmeter at the station, which is kept at constant reading by an attendant. Sometimes all the different pilot wires are grouped together at the station and indicate the average pressure at the voltmeter. This is done at Berlin. At Milan, however, the pressure is varied according to a tabular rule when the current varies. The use of pilot wires is, however, very desirable, but I hold that hitherto the pilot wires have generally been placed in the wrong position. Suppose that a 4 per cent. variation exists over the district of mains supplied by any one feeder, and that the point where the feeder strikes the mains is kept at constant pressure, then the most distant lamp supplied by that feeder has a variation of 4 per cent. If, however, the pilot wire came from a

point half-way between the most distant lamp and the feeder, and this point were kept at constant pressure, the maximum variation of pressure would be reduced to one half, and would be only 2 per cent. It appears, then, that by properly placing the pilot wires, the variations in pressure can be reduced to one-half; or, keeping the variations of pressure the same, the quantity of copper in the mains may be reduced to one-half.

In these suggestions as to dynamos at different pressures and as to the position of pilot wires, I am supporting a course which has not been generally adopted anywhere, but the improvement ought only to be mentioned to receive general recognition.

Lamps of Different Voltage.—It has often been proposed to supply different parts of a district with lamps of a different voltage. In the ordinary plan of using feeders and pilot wires the maximum pressure at the most distant lamp supplied by any feeder is the same as the pressure in the mains at the feeder. The minimum pressure may be, let us say, 4 volts less. Suppose 100-volt lamps are used, those near the feeder will always have 100 volts, but the most distant ones will have pressures varying from 96 to 100 volts. Ninety-six volts would make the lamps very dull; and if at the distant points lamps of 98 volts were used the pressure would never vary more than 2 per cent. from the normal, and a better light would be obtained. This would be a very good arrangement if we could lay out a district from the beginning with all the positions of the lamps established, but it is found as the station progresses a house which would have required 100 volts yesterday may require a limit of only 99 volts to-day, owing to the introduction of additional lamps between it and the feeder. Experiments which have been made in America on this plan have led to disastrous results and hopeless confusion in completing the scheme. This plan has been completely abandoned, and in the present state of the industry I think that this abandonment has been wise.

I do not think a greater variation of pressure than 2 per cent. up and down should ever be allowed if you wish to supply a satisfactory light.

I consider that success or failure of many electric light companies now doing central station work is very much dependent on their following or neglecting the proper rules for distribution, and I will illustrate the importance of these rules by a few examples.

1. A plain network by the two-wire system, fed at the central station with the economical size of copper conductors according to Sir William Thomson's laws—say, of 1,000 amperes per square inch—and going to a distance of 480 yards, would have a difference of pressure to which the distant lamps would be subjected of 24 volts.

2. On the three-wire system this would be 12 volts with one-fourth extra copper.

3. With the same amount of copper as in the last, properly arranged with feeders, the feeding points being 160 yards apart, the maximum variation of pressure in any lamp over the district is 2 volts, if the pilot wires come from the feeding centers.

4. Everything remaining the same as this last, except that the pilot wires are placed in the proper position instead of at the feeding points, the maximum variation is only 1 volt.

Putting it in other words, the quantity of copper required to limit the variation of pressure over the district to a certain figure is in the last case one-twelfth part of what it is in the second case, and one-nineteenth part of what it is in the first case.

High Pressure Distribution.—Before I leave the question of distribution let me now apply the same rules to the Gaulard and Gibbs system of using alternating currents with high pressure in the mains and low pressure in the houses, the reduction in pressure being effected by means of an induction apparatus called a "converter." At the present moment these converters are usually put in parallel upon the mains. There is a general impression in this country that it is not necessary to have feeders supplying the mains, even though the distance extends to several miles. Here, again, the experience of other countries has been set at defiance, although in a large town like London the importance of this rule is greater than most American cities, or in Rome. If such views continue to be adopted, the result will be as disastrous in the future as it has been in the past. In the most extensive system in this country, when there is a large demand for current, the distant lamps look like red-hot hairpins, even though the near lamps be at full brightness. This is due to defective distribution.

As already stated, there is a general belief in this country that to whatever extent the Gaulard and Gibbs system is used no trouble comes from variations of electric pressure over the district, even when the converters are placed in parallel. Let us look at this question a little closer. Returning to the two-wire system for low pressure, if we use 1,000 amperes to the square inch as the economical section for our conductors, the fall in pressure is 5 volts for 100 yards; the loss of pressure due to the house wiring amounts very generally to 2 volts—hence the total variation between the periods of maximum and minimum output is 7 volts per 100 yards, or about double what is permissible (4 volts); hence with the two-wire system such a size of conductor at 100 volts pressure could only be used for a distance of from 40 to 50 yards. Let us see how this distance is extended by using a pressure of 2,000 volts in the mains and 100 volts in the secondary. With the same density of current the loss of pressure in the house will be now 5 volts for 2,000 yards, to which must be added 2 volts for the house wiring and about 1½ volts for loss in the converter, making 8½ volts loss of pressure in 2,000 yards.

If we allow 4 volts varation in the lamps, which is quite a maximum, this allows only ½ per cent. variation in the mains, and then the greatest distance to which conductors can extend is 200 yards. The only means of extending the district is by the use of feeders. In America the practice prevails of allowing only ½ per cent. loss of pressure in the mains. I have taken a concrete case of 1,000 amperes per square inch, which may not always apply to actual conditions, but it shows the necessity of adopting the universal foreign practice of employing feeders, even with high-pressure mains.

[To be concluded.]

The Demand for Steel Pipes.

The *Ohio Valley Manufacturer*, says that since the welding of steel pipe has become an accomplished fact, and the consumers of pipe have begun to appreciate its greater durability and economy over iron pipe, the demand for it has grown with great rapidity. The Riverside (Ohio) Iron Works, which has the only steel pipe manufactory in this country, is pushed to its full capacity to supply the demand. Orders for large quantities are being booked almost daily, and they are compelled to reject those for immediate delivery. Like everything else in the commercial world, the purchaser wants the best for the least money; and in estimating the cost, durability and cost of handling are important factors to the sagacious business man. If spruce shingles and sheet steel can be had at the same price, he will choose the one that has the longest life and thus save in repairs. If iron pipe and steel pipe can be obtained at the same price he will choose the one that corrodes the least, that will last the longer and will be the cheaper to lay down. It has been demonstrated that steel pipe is the superior article in every respect, that it is more ductile, lighter to handle and less liable to corrosion, thus meeting every view of the economist. It needed no demonstration to convince the experienced iron man that steel is better than iron for any and all purposes, and when the difficulty of welding steel was overcome, all objections were removed. We are aware that some iron pipe manufacturers have experimented long and industriously to weld steel pipe, knowing that it would soon supplant iron; and some have exhibited specimens of their own failures to convince purchasers that it cannot be done. But it has been done most successfully at the Riverside, and if our doubting Thomases will call at the works here they will be shown welded steel pipe that cannot be detected by the natural eye.

Licensing Electric Light Employees.

The New England Electric Exchange, Boston, Mass., seems to deserve credit for being the the first to put into practical effect the plan—suggested something over a year ago, by the then President of the New York Electric Club—of causing examinations for the purpose of determining whether applicants for employment in the various electric branches were competent to fill the positions sought after.

A board of electricians has been selected by the afore mentioned Exchange, to examine candidates and issue licenses to these in some one of five classes. The first class is issued only to persons fully competent to install any electric light or power plant. He must have a general knowledge of the construction of such electric apparatus, of the principles of secondary batteries, and a thorough knowledge of the rules of the insurance companies upon installation of electric light apparatus. He must be able to make working drawings of central stations and isolated plants, to calculate the rules for electric wiring, and have an accurate knowledge of the electric lighting system which he desires to operate. The second-class license is issued to persons who could operate and install apparatus for any two of the following three; incandescent or arc lighting, or electrical transmission of power. His knowledge must be general upon the construction and operation of dynamo-electric machines, especially in regard to the apparatus which it is desired to operate. He must have also a thorough knowledge of the insurance rules and the rules governing electric wiring. The third-class licenses are for those who are competent to make electric light or power

installation, but are not considered competent to operate the electrical machinery. There is required a thorough knowledge of the calculations and rules governing electric wiring, ability to make plans, and a thorough knowledge of the action of electric lighting and power machinery, and also insurance rules. This class of licenses is obtained by graduates of technical institutions who have had a short practical experience. The fourth class of licenses are to persons competent to operate any one of the following systems: incandescent or arc light, or the electrical transmission of power. He must have a thorough practical knowledge of the installation and operation of such apparatus, and must also know how to do the wiring thereto, and must have a knowledge of insurance rules. The fifth class is issued to persons competent to operate electrical machinery, but not called upon to do electric wiring. His knowledge should be of a practical nature in regard to the work required from him, as well as to the insurance rules pertaining to the operation and care of such machinery. The care needed for electric welding apparatus is considered the same as that for electric lighting apparatus in the above classes.

The Board of Examiners meet every fortnight to examine candidates, issuing licenses with the proper degree of skill required. The plan has thus far met with the utmost success, and is being rapidly spread throughout the New England States. The examiners have confined their sittings to Boston, but in order to accommodate others at a distance they are to hold examinations at other places.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

In answer to several queries recently received by us concerning the Archer Gas Fuel Company, of Terre Haute, Ind., we make the reply that that Company owns the Archer patents for the States of Indiana and Ohio. The Company proposes to install fuel gas plants of the Archer type in various iron and steel works, for supplying heat to furnaces.

The new owners of the Warren (R. I.) Gas Company are much elated over the outlook for their property. The new plant will have a manufacturing capacity at least double that of the old one.

The Woonsocket (R. I.) Company will take advantage of the amendment recently made to its charter to allow the installation and operation of an electric lighting plant.

The guardians of Annie Walk—one of those who sustained injuries through an explosion of naphtha vapor that had escaped into the cellar of a house close by an imperfect storage tank of the Reading (Pa.) Consumers Gas Company—brought suit against the latter in the sum of $10,000. The case was tried before Judge Ermentrout and a jury, and a verdict of $6,333 was allowed. We think that his Honor's charge is fairly open to criticism; for on the point of contributory negligence—which was depended upon largely by the defence, as the plaintiff, who is little better than an infant, was sent by her parents to the cellar of their house, holding a lighted candle to guard her on her way—he spoke as follows: "The question is, did the act of the parents send this child into danger? The evidence is clearly affirmative on this point; but the next question is, was it natural and reasonable for the parents to apprehend that naphtha or gas escaping into"—it was known to the parents that naphtha vapors had been accumulating there—"the cellar would do so in such quantities as to be liable to produce an explosion when a light was brought into contact with it." The jury evidently agreed with the judge that such an understanding on the part of the child's parents was neither natural nor reasonable, hence the verdict. A new trial will be at once applied for, the principal claim therefor, we presume, being the plea that the sum awarded is excessive.

Mayor Price, of Macon, Ga., avows that the Macon gas war shall never be terminated by a combination and its consequences between the local gas companies. While we do not comprehend how Macon's chief executive proposes to prevent such an understanding or settlement, we might remind him that the proper time for him to have acted in consonance with the idea of securing cheap gas for Macon was when the opposition charter was handed to him for his signature by the Clerk of the Council. His veto of that document would have been the correct thing.

The Mammoth Springs (Ark.) Water, Light and Motor Company has been organized, with a capital of $50,000. Its officers are: President, Robert Grier; Vice-President, Thos. Star; Secretary and Treasurer, E. F. Brock; Directors, Robt. Grier, E. F. Brock, P. P. B. Hinson, Thos. Star and F. M. Daniels. An electric light plant will be installed immediately, and in all probability the water works will then be taken up. Mammoth Springs is as yet only mammoth in name, although it is eligibly situated, and may in time become quite a winter resort.

The Goodwin Gas Stove and Meter Company has just completed and put in position a very complete, handsome and elaborate set of testing apparatus in the office of Gen. Phil. Bate, the official gas examiner for the city of Louisville, Ky. The equipment includes a bar photometer, meter prover, apparatus for conducting sulpur and ammonia tests, suitable balances, cubic foot standard, etc.

Some hint has been advanced that the projectors of the Eastport (Me.) Gas Light Company were seriously considering the shutting down of the works, rumor also finding a reason for this in the supposed fact that the venture was being operated at a loss. Instead, however, of closing up, the owners are actually engaged in putting pipes through streets that never had been piped, and inadequate mains are being replaced by those of ample size. It seems, then, that Eastport is to have a better gas supply than ever.

The lower branch of the Massachusetts Legislature has concurred with the Senate resolution authorizing the Committee on Manufactures "to report in print" in regard to permitting the cities and towns of that State to engage in the manufacture and sale of illuminants.

Mr. Hammond has retired from the Superintendency of the Farmington (N. H.) gas works. Joel Smart succeeds him. It is possible that the proprietors will authorize Mr. Smart to institute a lower rate for gas; and there can be no doubt about it that such a move would better the Company's position.

The Committee on Street Lighting, Chelsea (Mass.) City Council, have been instructed to make the following offer to the Chelsea Gas Light Company for electric lights: "For 150 arcs, to burn until 12:30 A.M., and 50 to burn all night, at 20 and 30 cents, respectively, each per night, with a rebate of $45 for each night not lighted, less than 300 nights; also, 50 arc lights all night, at 30 cents each, 50, until 12:30 A.M., at 20 cents each, and 400 incandescent lights (20-candle power), more or less, to burn until 12:30 A.M., for 300 nights, at $14 per year for each light, and a rebate of $25 per night not used, said lights to be located by the committee."

The Pittsburgh newspapers seem to have been laboring under the delusion that electric lighting had all but superseded gas lighting—in and around the locality at any rate, that is pervaded by the personality of Mr. Westinghouse. Last month it appears that a reporter on the local *Commercial Gazette* made the discovery that some gas was yet being used in the city, and this discovery led him to inquire at the office of the Pittsburgh Gas Company as to what extent electricity had displaced gas as an illuminant. What he heard in respect to this—and his information was gathered from no less an authority than Supt. McElroy—upset him so greatly that his report to the readers of the *Gazette* bears the heading, "Still use for gas; electricity has not yet nearly taken its place entirely!" This must be very reassuring, for instance, to those "foreign and domestic syndicates" that have within a few weeks been investing millions of money in gas properties, and will also be very consoling to the gentlemen who manage gas works; but some of them—in fact many—are thoroughly alive to the security of their position, being only fearful that the summer may not give them sufficient hours of daylight wherein to carry out the extensions to plants that will be necessary to meet the demands of their consumers for gas in the dullness of the winter hours. This is what Supt. McElroy said to the young man from the *Gazette*: "The arc lights caused an increased consumption of gas, but the incandescents have to some extent displaced gas, though not to such a degree as one would think, from a superficial view of the matter. While, at first, many who put in the incandescent do away with the use of gas, they generally go back to the latter to a considerable extent, on account of the unsatisfactory lighting service from the incandescent lamps. When an incandescent lamp is first put in duty it yields a beautiful, bright light; but it gradually grows dimmer and dimmer each hour that it burns, and soon becomes a sickly yellow, beside which a gas jet in good order is as bright as an arc lamp. The electric light is brought down so much nearer the face ordinarily than gas that many persons are deceived as to the relative light power in contrast with gas, and the effect of this is becoming painfully apparent to those who use the elec-

trics. It is hard on the eyes. I have heard many complain of that feature, and where the arc light is used, as in the postoffice, for instance, the effect is doubly injurious. Given, candle power for candle power of light, gas is considerably cheaper as an illuminant. However, I wish to say nothing derogatory to the use of electricity. It is a great and wonderful thing, and has capacities as yet undiscovered which will no doubt startle the world; but it is not driving gas out to any extent. Natural gas has caused a greater diminution in the use of illuminating gas than that chargeable to electricity."

THE proprietors of the Fitchburg (Mass.) Gas Company, having purchased the plant and franchises of the local electric light company, will locate the generating station on a plot adjoining the gas works.

THE gasholder now being put up by the Newton and Watertown (Mass.) Gas Company will be on the two-lift order, and will have a capacity of 200,000 cubic feet. This makes the fifth storage vessel that has been ordered by the Company since its formation in 1854.

THE Wight interest that dominated the policy of the Trinidad (Colorado) Gas Company for many years, was overthrown at the annual meeting, held towards the close of April. The stockholders are now represented by the following executive management: President, David Gottlieb; Vice-President, Hon. James M. John; Secretary and Treasurer, B. Levy. A resolution was also adopted reducing the price of gas to $1.50 per 1,000 cubic feet, from $2.50. It is not presumed that this concession is to be permanent, but is to be regarded as the first step in a war for supremacy between the gas and electric lighting interests of the city. The strife is likely to be a protracted one, from the fact that the electric service is controlled by F. D. Wight, former President of the Gas Company.

WE understand that the authorities of Portsmouth (O.) are considering a proposition submitted to them by the Portsmouth Gas Company, under which the latter agrees to lease the electric light plant owned by the city, the lessees to maintain the present public electric light schedule for the sum of $3,500 per annum. The authorities may not ratify this proposition, but in any event they are agreed over the fact that it was a grave mistake to commit the city to the operation of a municipal lighting plant.

THE following tables (taken from the last annual report of the Massachusetts Board of Gas Commissioners) show the percentage of increase in sales of gas in Massachusetts over the previous year, the average price received for all gas sold during the year ending June 30, 1888, and the average price received for the preceding year. Asterisks show decrease.

Coal Gas Companies.

Company.	Increase over 1886-87. Per cent.	Average Price per M. for Gas Sold, 1887-88.	Average Price per M. for Gas Sold, 1886-87.
Adams	7.69*	$2.35	$2.41
Amesbury	....	1.98	....
Arlington	3.95	2.69	3.00
Attleborough	7.70	2.25	2.25
Beverly	9.92	2.57	2.59
Boston	6.15	1.31	1.45
Brockton	1.70	2.09	2.24
Brookline	8.85	2.16	2.18
Cambridge	4.50	1.68	1.69
Charlestown	7.19	1.72	1.72
Chelsea	15.14	2.10	2.12
Chicopee	19.44	1.95	2.30
Citizens (Quincy)	6.64	2.38	2.44
Citizens (Wakefield)	1.53	3.32	3.36
Clinton	6.14*	2.15	2.19
Cottage City	[1]	2.00	....
Danvers	14.30	3.20	3.27
Dedham	5.93*	2.67	2.82
Dorchester	15.31	2.14	2.14
East Boston	6.01	1.76	1.81
Easthampton	2.38	2.50	2.68
Fall River	7.86	1.57	1.76
Fitchburg	29.07	1.86	1.90
Gloucester	16.71	1.80	2.01
Greenfield	29.66*	2.39	2.59
Haverhill	15.14	1.51	1.60
Holyoke	8.25	1.74	1.97
Jamaica Plain	14.24	2.12	2.15
Lawrence	8.95	1.43	1.43
Lowell	7.37	1.19	1.29
Lynn	14.04	1.79	1.83
Malden	20.74	1.99	2.16
Manufacturers (Fall River)	1.05*	1.54	1.71
Marblehead	15.97	2.76	2.81
Marlborough	17.62	2.44	2.70
Milford	26.43	1.97	1.98
Miller's River (Athol)	18.92	2.45	2.40
Nantucket	2.51*	2.76	2.80
Natick	19.96	2.55	2.81
New Bedford	7.80	1.58	1.63
Newburyport	14.65	2.00	2.13
Newton	6.20	2.03	2.25
North Adams	10.80	1.83	1.96
Northampton	8.47	1.98	2.10
North Attleborough	5.09	2.23	2.47
Norwood	62.92	2.47	2.52
Pittsfield	3.04*	1.99	2.01
Plymouth	2.65	2.23	2.27
Roxbury	7.67	1.71	1.73
Salem	4.89	1.80	1.80
South Boston	6.39	1.75	1.78
Spencer	[1]	1.25	....
Springfield	15.84	1.72	1.94
Taunton	10.26	1.59	1.59
Waltham	13.58	1.81	1.92
Ware	29.37	2.54[2]	2.55[2]
Webster	20.21	2.57[2]	3.33[2]
Westfield	16.94	2.34	2.33
Woburn	4.27	1.99	2.07
Worcester	14.00	1.51	1.82

Oil Gas Companies.

Amherst	0.41*	5.36	5.39
Chicopee Falls	11.18	3.63[2]	4.79[2]
Gardner	....	5.61	....
Great Barrington	12.67	4.80	4.47
Ipswich	4.68*	3.05	2.72
Lee	15.89	7.50	7.50
Leominster	14.82	4.81	5.06
Lexington	0.83*	5.26	4.84
Middleborough	[1]	4.09	[1]
Mutual (Southbridge)	11.61	3.00	3.00

1. Quantity last year not returned. 2. Average price for gas sold to the public.

WE are not advised that a decision has as yet been given in the matter of the application to the authorities of Amherst, Mass., by the gas company for the right to install and operate an electric lighting plant. In the meantime a rather formidable opponent to the gas company has appeared in the shape of a company, numbering in it some of Amherst's solid men, that handed in a similar petition some months prior to that submitted by the gas company. The "solid men" now claim that if such a franchise is to be issued, it should be granted to those first in the field, although the first comers did not seem to be in any hurry to get at work until others moved in the matter. If the "solid men" are awarded the franchise, they propose to introduce the Weston incandescent system.

MR. THEODORE HOSMER, of the Tacoma (Washington) Light and Water Company, is very enthusiastic about the future of Tacoma in general and of the solidity of the Light and Water Company in particular. He has good reason, too, for this enthusiasm, because he has, through increasing the Company's capital stock, secured the moneys necessary for the carrying out of a huge betterment scheme on water and gas plant account. The water conduits are to be extended by the placing of 15 miles of pipe, the gas works capacity is to be doubled, and the electric lighting department has developed with such rapidity as to demand the construction of an additional building wherein to house the necessary apparatus. Five 50-light dynamos are now in service, and another is in transit. The city is said to be growing very rapidly, and certainly the pace at which the Tacoma Light and Water Company is traveling seems to prove that assertion.

ABOUT a year ago we had occasion to chronicle the formation in Brooklyn, N. Y., by a certain coterie of retail dealers in furniture, of the Peoples and Consumers Gas Company. Subscription books were

opened and the "people and consumers" were invited to subscribe for shares. Latterly not much had been heard from the concern, but a few days ago the Treasurer (Charles W. Sisson) thought the courts might be able to assist him in collecting some money from the Company. The gist of the Sisson trouble seems to be about like this: Lindley Murray, President, in looking around for a Treasurer, encountered Mr. Sisson, who was told that if he would subscribe for 200 shares of stock (par $10), paying $400 down, he would be made Treasurer. His salary was to be $20 per week "until $250,000 had been taken in on account of stock sales, when the stipend would be increased to $4,000 per annum." Sisson paid over the $400 and walked into the office. In the meantime, investors were not plentiful—although some cash was taken in—and the crop did not last long. Current expenses (rent, stationery, advertising, President Murray's salary—he drew $100 per month—Sisson's weekly $20, etc.) were paid out of the stockholders' subscriptions as long as the cash lasted. Finally the fund was exhausted, there were no new buyers, and Sisson thought it was time to save his $400. President Murray said that Sisson's cash had gone with the rest, and as the Company was indebted to him—Murray—he failed to see how Sisson could expect any salvage. The law will be invoked, and it is just possible that President Murray may have an anxious spell of it in explaining away certain odd financial features connected with his management of an enterprise, to use his own words of a year ago, intended "to free the people of Brooklyn from the robber-like clutch in which they were held by the existing gas suppliers."

THE Board of Public Affairs has notified the Cincinnati Gas Company to locate a high candle power gas lamp at the intersection of Fourth and Vine streets.

THE following bit of information is from the Newark (N. J.) *Advertiser:* "President Smalley, of the Citizens Gas Company, when interviewed in reference to the statement that a great gas trust had been formed which would eventually include the Newark gas companies, said that the Delaware Legislature had granted a charter to the Peninsula Investment Company, capitalized in $12,000,000. The object of the charter is said to be to effect a consolidation of all the gas companies in the New England States and the cities of Brooklyn (N. Y.) and Newark (N. J.) The combination, which is headed by Mr. Addicks, now own about 20 companies, but they have been unable to consolidate them. Mr. Smalley said that he had been unable to learn anything about the Company's operations in Newark, and that as far as his Company (the Citizens) was concerned, no overtures looking to consolidation had been instituted. President Vanderpool, of the Newark Gas Company, was not at his office when the reporter called. It was said, however, that such a consolidation had been talked of and was not altogether an improbability."

A PROJECT is on foot for the establishment of a gas works at Duquoin, Ills. Duquoin is a post village of Perry county, and is on the Illinois Central Railroad, about midway of Cairo and St. Louis. It is 71 miles southeast of the latter city, with which it is connected by the St. Louis, Alton and Terre Haute Railroad. Valuable bituminous coal deposits, easily worked, abound, and form the basis for the prosperous condition of the place. Population, about 6,500.

IN the case of Edwin J. Ryan against the Washington (D. C.) Gas Light Company, the jury brought in a verdict for plaintiff in which the damages were assessed at $550. On the afternoon of September 25, 1887, Ryan, while walking along G street, stepped inadvertently on a part of the sidewalk that held one of the Company's cut off boxes, and fell to the ground, his wrist being fractured because of the fall. It was shown at the trial that the box had been on grade, and that as the District Government changed the original grade of the street—the box had not been raised, however—the suit should have been against the District. Judge Montgomery held that the Company, having been notified of the change of grade should have raised its box to the level called for by the new street conditions, and was therefore liable.

IN all probability one result of the gas explosion at Syracuse, N. Y., reported in our issue for last week, will be the creation of the office of an inspector of plumbing for that city.

SOME investors might glean something of value from this notice: "As Trustee of the city of Louisville, and in pursuance to authority granted by the 17th section of the charter of the Louisville Gas Company, approved March 16, 1888, said Company will on the 15th day of May, 1889, at the Board of Trade rooms, in said city, at the hour of 12 o'clock M., sell publicly the following bonds of the city of Louisville, viz.: Fourteen 5 per cent. 10-20 bonds of $1,000 each, and fourteen 5 per cent. 20-40 bonds of $1,000 each; to raise a sum sufficient to pay the indebtedness of said city to said Company, on the 31st of December, 1888, for public lights."

THE Committee of Incorporations (Connecticut Legislature, House branch) has made a favorable report on the petition to validate the charter of the Wallingford Gas Light Company.

THE Fresno (Cal.) Supervisors have granted a franchise to M. G. Elmore, under which he will construct a gas works in the town of Selma. The works must be in operation by September 1st.

ON March 30th the authorities of Hillsdale, Mich., entered into a contract with F. W. Stock, under which the latter bound himself to light the county buildings, by means of electricity, for a period of 5 years from the 1st ult. The Hillsdale Gas Company contended that the authorities could not legally bind the city on a contract of this nature for a period exceeding the official life of the local Board of Supervisors, and Secretary Branch having determined that the Gas Company's view should be passed on judicially, has applied for an injunction restraining the city from carrying out its agreement with Stock. The statutes of Michigan bearing on this point look to be all in favor of the Gas Company's way of construing them.

THE new holder for the Columbus (Ga.) Gas Light Company is to have storage capacity for 75,000 cubic feet. The entire scheme of betterments proposed at Columbus will require an expenditure of $25,000, and the work is to be completed by September 1st.

THERE was great competition this year among the Pittsburgh coal operators for the right to furnish the Detroit (Mich.) Gas Light Company with gas coal. The quantity bid on was 16,000 tons, and the awards were made to the Youghiogheny and Ashtabula Coal and Coke Company, and to Osborn, Sager & Company (West Newton Mines), each to furnish 8,000 tons, at $2.16 per ton afloat at the Gas Company's wharves in Detroit. Last year the price paid for screened coal (1½-inch mesh) was $2.65 per ton.

THE public lighting of Batavia, N. Y., has at last been arranged, the contract having been awarded to the Cousumers Electric Light and Power Company, on the basis of a three-year contract, to commence in August next. Sixty full arcs are to be maintained, up to midnight of each night, and 15 are to be kept burning all night. The rate is: 1st year, $4,000; 2d year, $3,700; 3d year, $3,500. The other bidders were the Batavia Gas Light Company, which asked $4,500 per annum for the work, and the Jordan Electric Light Company, whose figure was $4,485 per annum. Looking at these latter bids, one cannot fail to receive the impression that the Gas Company's bid was no sealed book to the Jordan Company's estimators.

THE annual meeting of the Buffalo (N. Y.) Gas Light Company wil be held to-morrow.

THE Gas, Heat and Power Company (organized in Portland, Me., with a capital of $500,000) is officered as follows: President, A. D. Warren, Worcester, Mass.; Treasurer, Henry S. Payson, Portland, Me.; Directors, A. D. Warren, A. D. Loveren and Henry S. Payson. The objects are: "To carry on the business of manufacturing, building, providing, acquiring, holding, using, leasing and renting plants, buildings, etc., for the manufacture and sale of gas for illuminating, heating and power purposes." This looks to be a sound corporation, for its Treasurer is a member of one of the most reliable financial houses in the Eastern States.

THE differences between the bondholders and stockholders of the Birmingham (Ala.) Gas and Electric Light Company have been adjusted on what seems to be a fair plan. The rate of interest on the senior securities is reduced to 6 per cent., and provision has been made to raise a fund that will not only wipe out the floating debt, but also leave a good working balance in the treasury.

THE Stoughton (Mass.) Light, Heat and Power Company is working under what is known as the Shaw process, and the gas supplied is said to give good satisfaction to the consumers.

The Market for Gas Securities.

The centennial celebration is responsible for much uncertainty in Wall street just now, the brokers seemingly being at a loss in determining whether the market is open or not. In any event, however, buyers and sellers seem a unit in respect to the value of Consolidated gas, sales in which, up to noon to-day (May 5), were 89 to 89¼. We understand that the executive management of the Company is not a unit over the proposed increase in the rate of dividend to 5 per cent., but nevertheless it is reasonably certain that such a step will be decided on. Other city shares are strong, and we still hold to it that Equitable presents an excellent opportunity for profitable investment. Brooklyn shares are strong, and there is nothing new in the status of the proposed Francklyn absorption.

In our last a typographical error made the time for final payment in the Rochester purchase close on May 3d. The date should have been reported as May 23d. The annual election of the Chicago Gas Trust is over, and we have not had advice that a dividend was declared. The stock, however, remains fairly steady at a half point under 50. By-the-way, we take this opportunity to say that the Company has granted a well-earned vacation to Mr. Forstall, who, in company with his wife, sailed for Europe, by the French line, last Saturday. They will return late in the summer.

Eastern gas shares are booming, an instance being furnished by a recent transfer of Lowell (Mass.) gas at 215—just 15 points over the last prior recorded sale. The St. Louis deal is not a fixed fact as yet.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

May 6.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	89¼	—
Central	500,000	50	—	—
" Scrip	220,000	—	47	57
Equitable	4,000,000	100	115	117
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	--	—
Metropolitan, Bonds	658,000	—	116	118
Mutual	3,500,000	100	102	103
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern	125,000	50	30	—
" Scrip	108,000			
Yonkers		50	90	100
Richmond Co., S. I.	346,000	50	55	60
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	—	104
Citizens	1,200,000	20	60	70
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	123	125
" Bonds	300,000		—	106
Peoples	1,000,000	10	71	73
" Bonds (5's)	368,000	—	97	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	88	90
Nassau	1,000,000	25	111	113
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	119	122
" Bonds	1,000,000	—	109	112

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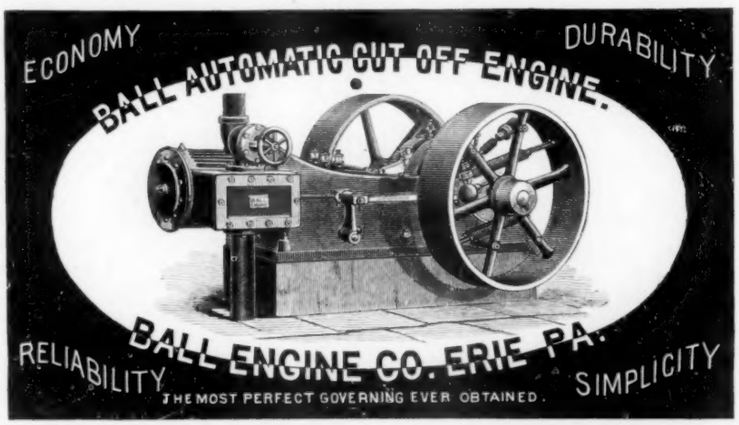

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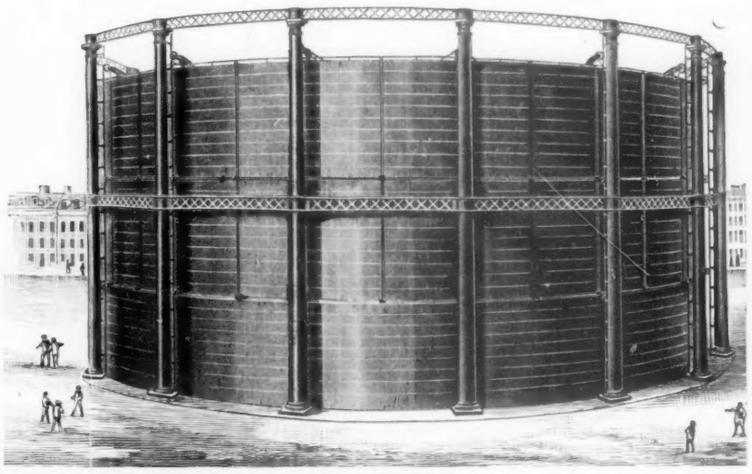

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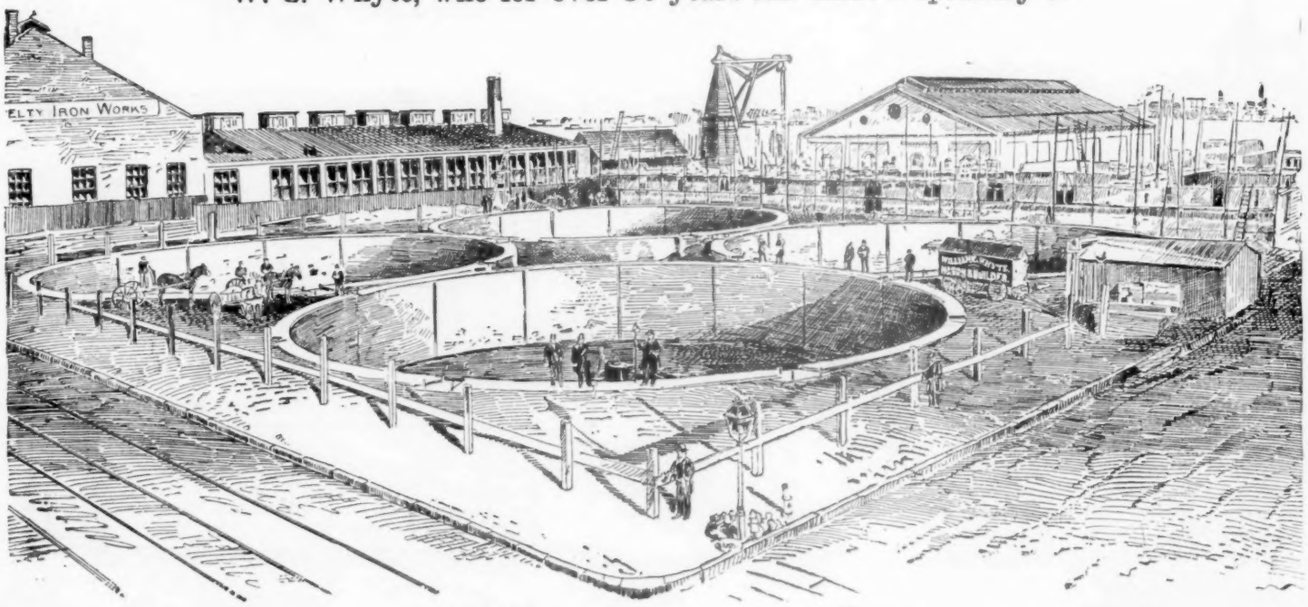

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"	1,000,000
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Copenhagen	200,000
Clevedon	200,000
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Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
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Dowlais	100,000
Donai	500,000
Denton	500,000
Derby, U.S.A.	350,000
Denver, "	500,000
" "	1,000,000
Dusselldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z.	400,000
Darlington	1,250,000
Detroit, U.S.A.	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
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Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W.	100,000
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Holywood	125,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwicke	500,000
Haverfordwest	100,000
Halifax, N.S.	350,000
Hamm	200,000
Halle	400,000
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Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kiddermmster	750,000
Kidsgrove	100,000
Konigberg	1,000,000
King's Lynn	300,000

LONDON:—

The Gaslight and Coke Co.:	
Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

LONDON—*Continued.*	Capacity. Cubic feet per day.
Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	500,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W.	100,000
Minneapolis, U. S. A	750,000
Magdeburg	300,000
Memphis, U. S. A	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A	430,000
Newmarket	150,000
Newark, U.S.A	680,000
Northfleet	200,000
New York, U.S.A	2,000,000
Nice	600,000
Newcastle, N. S. W.	200,000
Numea, "	100,000
Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000

	Capacity. Cubic feet per day.
Ober Schlesian	1,500,000
Otto & Co.'s Coke Works	1,500,000
Plymouth	2,000,000
Parramatta, N. S. W.	100,000
Prescott	150,000
Providence, U.S.A.	750,000
"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,500,000
"	2,500,000
Pittsburgh, U.S.A.	1,500,000
Portland, "	560,000
Pawtucket, "	500,000
Quebec	250,000
Radcliffe	750,000
Rouen	250,000
Ramsgate	1,000,000
Reigate	200,000
Richmond, U.S.A.	250,000
Roxbury, "	500,000
Runcorn Soap Co.	20,000
Rockhampton, N. S. W.	125,000
Richmond	1,500,000
Reading	2,000,000
Reichenbach	200,000
Salford	1,750,000
"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W.	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sunderland	1,500,000
St. Josephs, U.S A	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A.	2,000,000
"	2,000,000
"	1,000,000
Laclede	1,000,000
Silesian Coal Co.	600,000
San Francisco, U.S.A.	2,000,000
"	2,000,000
Sheepbridge Coal Co.	40,000
Stettin	200,000
Singapore	300,000
Sutton	500,000
Tonbridge	150,000
Tipton	400,000
Tottenham	1,000,000
Toledo, U.S.A.	750,000
Toronto	1,000,000
Uxbridge	300,000
Valparaiso	500,000
West Bromwich	1,000,000
Willenhall	250,000
Weston-super-Mare	500,000
Waltham	150,000
Wormwood Scrubs	300,000
Williamsburg, U.S.A.	600,000
"	600,000
Wellington	150,000
Warwick	300,000
Wheeling, U.S.A.	500,000
Walker	300,000
Westgate	100,000
Wilmington, U.S.A.	500,000
Windsor, N. S. W.	100,000
Wolverton	100,000
Wellington, N. Z.	250,000
Whitchurch	175,000
Washington, U.S.A.	2,000,000
Wallasey	750,000
Weimar	150,000
Wurzen	200,000
Worcester, U.S.A.	750,000
Yeadon	500,000
Yeovil	250,000

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Erected and in course of construction at present date:

	Capacity. Cubic feet per day.
Altrincham	600,000
Adelaide	600,000
Aldershot	200,000
Allegheny, U. S. A.	1,000,000
Ashton-under-Lyne	1,250,000
Amsterdam	1,500,000
"	1,500,000
Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U.S.A.	1,000,000
"	1,000,000
"	1,000,000
Balmain, N.S.W	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Burntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
Burton-on-Trent	1,500,000
Barcelona	350,000
Barking	100,000
Baerlien & Co	20,000
"	20,000
Bombay	400,000
Buffalo, U.S.A., Mutual	750,000
" Citizen	500,000
Brookline, U.S.A.	500,000
Bergen	350,000
Berlin	1,250,000
Bournemouth	1,000,000
Bridgeport, U.S.A.	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U.S.A.	1,000,000
"	1,000,000
" Nassau	1,000,000
Brunner, Mond & Co.	400,000
Cheltenham	2,000,000
Cannes	200,000
Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A.	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000

	Capacity. Cubic feet per day.
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A.	350,000
Denver, "	500,000
" "	1,000,000
Dusselldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z.	400,000
Darlington	1,250,000
Detroit, U.S.A.	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W	100,000
Grieg	300,000
Georgetown, U.S.A	250,000
Gluckauf	200,000
Heywood	600,000
Holywood	125,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwicke	500,000
Haverfordwest	100,000
Halifax, N.S.	350,000
Hamm	200,000
Halle	400,000
Heidelberg	300,000
Hartford, U.S.A	1,000,000
Ilkeston	300,000
Inverness	250,000
Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kidderminster	750,000
Kidsgrove	100,000
Konigberg	1,000,000
King's Lynn	300,000

LONDON:—

The Gaslight and Coke Co.:	
Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

LONDON—*Continued.*	Capacity. Cubic feet per day.
Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	500,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W.	100,000
Minneapolis, U. S. A.	750,000
Magdeburg	300,000
Memphis, U. S. A	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A	430,000
Newmarket	150,000
Newark, U.S.A	680,000
Northfleet	200,000
New York, U.S.A	2,000,000
Nice	600,000
Newcastle, N. S. W.	200,000
Numea, "	100,000
Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000

	Capacity. Cubic feet per day.
Ober Schlesian	1,500,000
Otto & Co.'s Coke Works	1,500,000
Plymouth	2,000,000
Parramatta, N. S. W.	100,000
Prescott	150,000
Providence, U.S.A.	750,000
"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,500,000
"	2,500,000
Pittsburgh, U.S.A.	1,500,000
Portland, "	560,000
Pawtucket, "	500,000
Quebec	250,000
Radcliffe	750,000
Rouen	250,000
Ramsgate	1,000,000
Reigate	200,000
Richmond, U.S.A.	250,000
Roxbury, "	500,000
Runcorn Soap Co.	20,000
Rockhampton, N. S. W.	125,000
Richmond	1,500,000
Reading	2,000,000
Reichenbach	200,000
Salford	1,750,000
"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W.	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sunderland,	1,500,000
St. Josephs, U.S A	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A	2,000,000
"	2,000,000
"	1,000,000
Laclede	1,000,000
Silesian Coal Co.	600,000
San Francisco, U.S.A	2,000,000
"	2,000,000
Sheepbridge Coal Co.	40,000
Stettin	200,000
Singapore	300,000
Sutton	500,000
Tonbridge	150,000
Tipton	400,000
Tottenham	1,000,000
Toledo, U.S.A	750,000
Toronto	1,000,000
Uxbridge	300,000
Valparaiso	500,000
West Bromwich	1,000,000
Willenhall	250,000
Weston-super-Mare	500,000
Waltham	150,000
Wormwood Scrubs	300,000
Williamsburg, U.S.A	600,000
"	600,000
Wellington	150,000
Warwick	300,000
Wheeling, U.S.A	500,000
Walker	300,000
Westgate	100,000
Wilmington, U.S.A	500,000
Windsor, N. S. W.	100,000
Wolverton	100,000
Wellington, N. Z.	250,000
Whitchurch	175,000
Washington, U.S.A	2,000,000
Wallasey	750,000
Weimar	150,000
Wurzen	200,000
Worcester, U.S.A	750,000
Yeadon	500,000
Yeovil	250,000

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C. R. I. & P. R. R. Shops	Chicago, Ill.
Decatur Gas Light and Coke Co.	Decatur, Ill.
Niles Gas Light Co.	Niles, Mich.
Newton Illuminating Co.	Newton, Kansas.
Wellington Light and Heat Co.	Wellington, Kansas.
Chippewa Falls Gas Light Co.	Chippewa Falls, Wis.
Elkhart Gas Light and Coke Co.	Elkhart, Ind.
Madison City Gas Light Co.	Madison, Wis.
South Bend Gas Light Co.	South Bend, Ind.
Sheboygan National Gas Co.	Sheboygan, Wis.
Salina Gas Light Co.	Salina, Kansas.
The Rathbun Co.	Deseronto, Prov. Ont.
Jefferson City Gas Light Co.	Jefferson City, Mo.
Mankato Gas Light Co.	Mankato, Minn.
Minneapolis Gas Light and Coke Co.	Minneapolis, Minn.
Lima Gas Light Co.	Lima, Ohio.
Bellevue Water and Fuel Gas Light Co.	Bellevue, Campbell County, Ky.
Bucyrus Gas Light and Fuel Co.	Bucyrus, Ohio.
Morris Gas Co.	Morris, Ill.
Los Angeles Gas Co.	Los Angeles, Cal.
San Diego Gas Fuel and Electric Lt. Co.	San Diego, Cal.
Sioux Falls Gas Co.	Sioux Falls, Dak.
Dakota Gas and Fuel Co.	Grand Forks, Dak.
St. Johns Mutual Gas Co.	St. Johns, Mich.
Stillwater Gas Light Co.	Stillwater, Minn.
St. Paul Gas Light Co.	St. Paul, Minn.
Emporia Electric and Gas Light Co.	Emporia, Kas.
Van Wert Gas Light Co.	Van Wert, Ohio.
Lansing Gas Light Co.	Lansing, Mich.
San Francisco Gas Light Co.	San Francisco, Cal.
Shelbyville Gas Light Co.	Shelbyville, Ind.
Great Falls Gas Light Co.	Great Falls, N. H.
Belleville Gas Co.	Belleville, Ontario.
Rochester Light and Fuel Co.	Rochester, Minn.
Northwestern Gas Light and Coke Co.	Evanston, Ill.
Lincoln Gas Light Co.	Lincoln, Neb.
Davenport Gas Light Co.	Davenport, Iowa.
Municipal Gas Co.	Albany, N. Y.
*Alliance Gas Light Co.	Alliance, Ohio.
*Chicago Gas Light and Coke Co.	Chicago, Ill.

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"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying agent ever offered as a substitute for lime. Now used *in every State in the Union*, and purifying daily over *thirty-five million cubic feet.* Should be used in every gas works. Its own saving will pay for it many times over.

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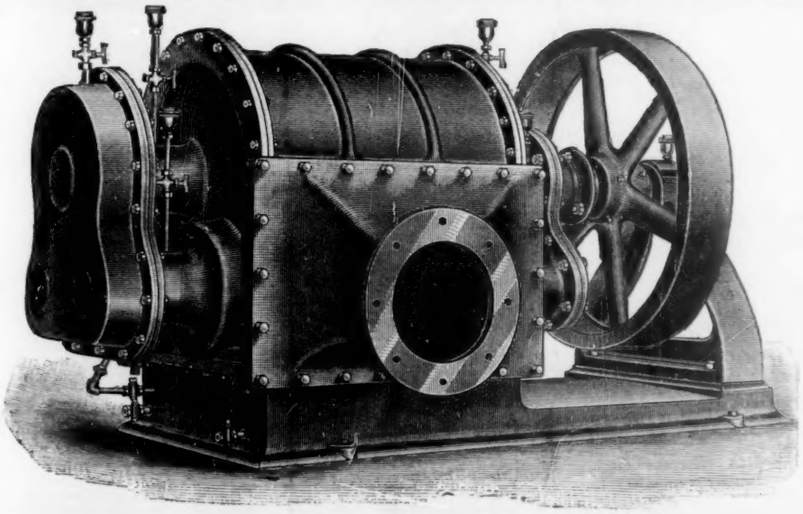

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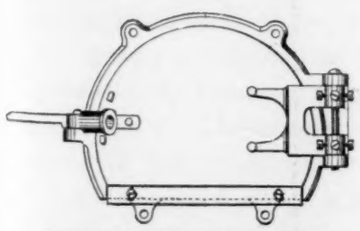

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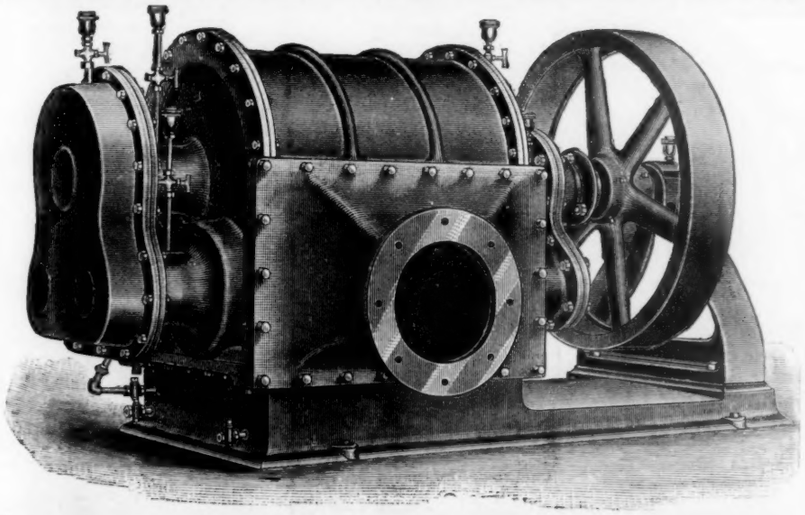

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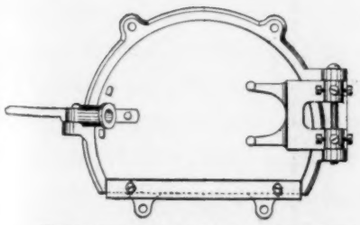

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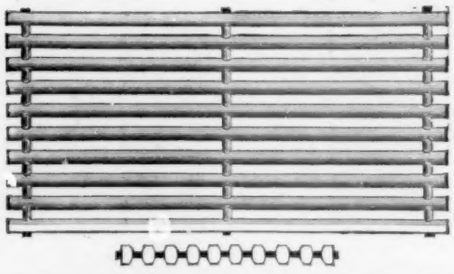

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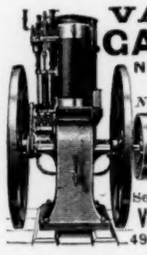

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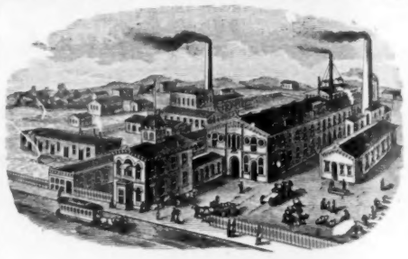

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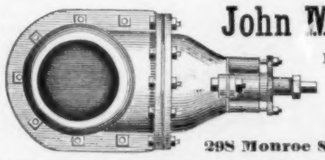

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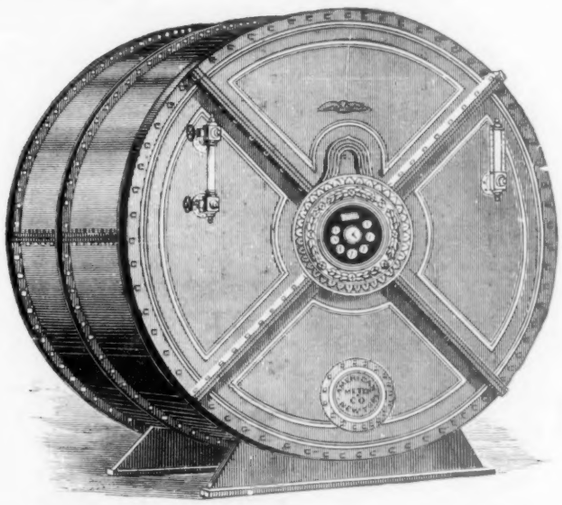

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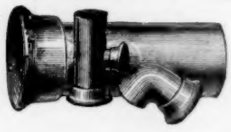

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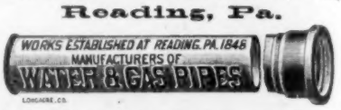

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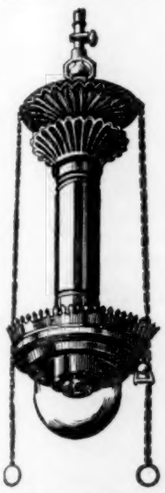

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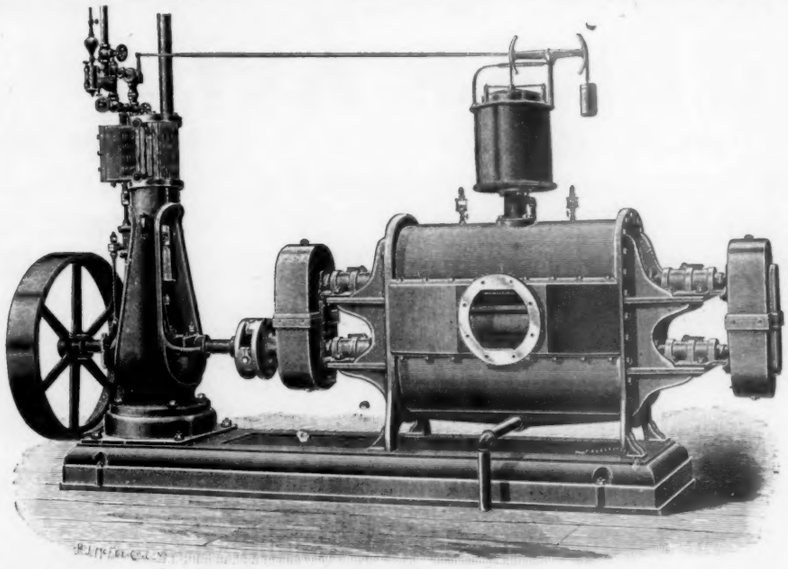

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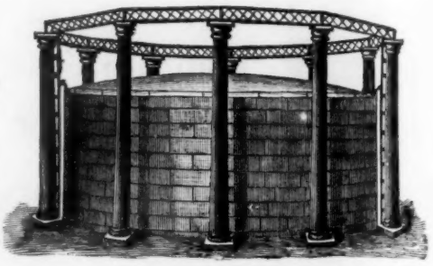

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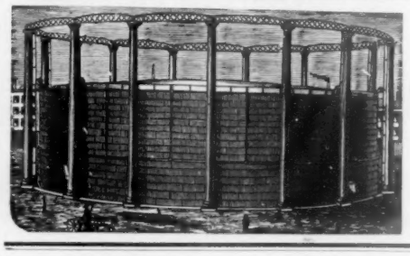
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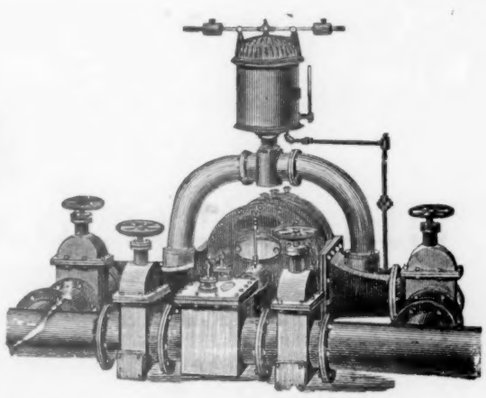

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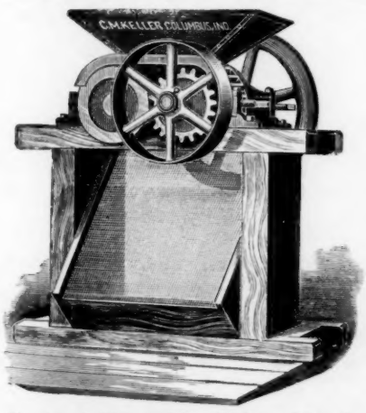

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Gas Companies are given by the Otto Gas Engine superior means for Production of Power and Electric Light.

In Theory the Otto Gas Engine realizes 18 per cent. actual work out of number of heat units in fuel consumed, while the ordinary steam plants reach but 12 per cent. **In Practice** a comparison of cost in dollars and cents between gas and steam power stands as follows (the figures below being taken from actual experience):

50-H.P. STEAM ENGINE AND BOILER, Running a Plant of Fifty 2000-C.P. Arc Lamps 12 Hours.	
4,500 lbs. Indiana nut and slack, at $1.30 per ton	$2 93
Engineer, one night, at $50 per month	1 67
Trimmer, one day, at $40 per month	1 33
Superintendent or Electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05
Water rent, one day, at $40 per year	11
Wheeling coal and removing ashes, at $4 per week	58
100 pairs carbons, at $18.50 per 1000	1 85
One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$10 38

50-H.P. OTTO GAS ENGINE, Running a Plant of Fifty 2000 C.P. Arc Lamps 12 Hours.	
9,200 cu. ft. gas, at 42 cts. per M. (for cost of gas see items below)	$3 86
Engineer not needed; engine is in care of Electrician or Supt.	....
Trimmer, one day, at $40 per month	1 33
Superintendent or electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05
Water rent dispensed with (cooling water used over and over)	....
Handling of coal included in cost of gas	....
100 pairs carbons, at $18.50 per 1,000	1 85
One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$8 95

Expenses of depreciation, repairs, and interest omitted, being considered the same in both cases—though depreciation and repairs are much higher with steam on account of boiler and its appurtenances. Cost of gas in the holder we estimate for most of the Middle and Western States as follows: Coal, 30 cts.; labor, 20 cts.; purification, 2 cts.; total, 52 cts. Less coke, 7 cts., and tar, 3 cts.; leaving net cost of gas 42 cts. The items of Superintendence and repairs, being paid for by the gas sold to consumers, need not be charged on extra output for gas engine consumption. Where the cost of gas is higher than here figured, coal for steam use will be found proportionally higher, and final figures of comparison show same amount of saving.

Excess in Cost of Steam over Gas Power is thus $1.43, or nearly 16 per cent.

Coal for getting up steam and banking fires is not included in above figures, and should be added, thus increasing rate of economy of gas power beyond that shown by our figures.

Where Gas Companies adopt Gas Power for Electric Plants, Water Works, Sewerage, etc., they not only choose **the most economical power for their use,** but secure to themselves the **numerous advantages of increased production,** without increase of expense, and benefit thereby their entire manufacture. They induce consumers, by their example, to abandon Steam for Gas Power, and, by establishing special rates, make

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